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ABSTRACT

Most of the 15 papers presented here were originally presented at a May, 1987 colloquium held in Columbus, Ohio, on "The Educated Citizen and the University of the Future." Papers and their authors are as follows: "Thinking About the University of the Future" (Richard Bjornson and Marilyn R. Waldman); "The Old and the New: The University of Today and the University of Tomorrow" (Germaine Bree); "The Structure of the University and Goals and Values" (Charles E. Odegaard); "Public Education in the Twenty-First Century" (Edward H. Jennings); "The Challenges for Public Higher Education" (Myles Brand); "Education and the Public Research University" (Kenneth H. Keller); "From the Tower to the Trenches: The University and the High Tech Race" (Dorothy Nelkin); "University-Business Partnerships for Economic Development" (Angel G. Jordan); "Education: A Capital Investment" (John R. Haire); "Dynamic Alliances Between Business and Higher Education" (Andrew I. Wolf); "Philanthropic Studies at the University of the Future" (Robert Payton); "The University and the Black Athlete" (Harry Edwards); "Computers and the University: From Mental Models to Graphic Media" (Lynn A. Cooper); "A Dialogue on Computers and Education" (Franklin Roberts and Charles Csuri); and "Survey of Faculty Opinion About the University of the Future" (Ella Kirk and Richard Bjornson). References accompany most papers. (GLR)

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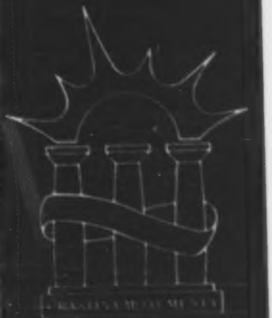
Problems and Prospects



Richard Bjornson
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Editors

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Problems and Prospects

Richard Bjornson
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1990

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Thinking About the University of the Future

Richard Bjornson and Marilyn R. Waldman

To think about education is to think about the future within a context that has been shaped by the past and reconfigured in response to the needs of the present. What happens in the universities of today will help determine the future of our society and its capacity to cope with the challenges of tomorrow. At the same time, universities remain one of society's most important vehicles for preserving and transmitting cultural values from the past. They are also increasingly being called upon to solve societal and technical problems in the present. During the past 100 years, American universities have expanded enormously, extending their teaching and research activities into new areas of knowledge and accommodating a broader segment of the total population than ever before.

Stresses engendered by competing claims on the university's resources, by disagreement over the goals it should be pursuing, and by various perceptions of its shortcomings have led to a spate of reports on the state of higher education in America.[1] These reports and many of the books published on the subject in recent years have identified problems and offered various solutions for dealing with them,[2] but they have often failed to raise issues crucial to the future of higher education in this country. What are the consequences of the American university's embeddedness in a specific social-historical context? How can it fulfill its dual responsibility to the past and to the future? What is its role in preparing future citizens to act intelligently and ethically? How can it reconcile conflicting conceptions of its teaching and research functions? What is an appropriate relationship between the university and government, between the university and corporate America?

Most of the essays collected in this volume were originally presented in somewhat different form during a colloquium that was organized to address these sorts of questions.[3] By focusing on two major questions, the participants in this colloquium helped clarify what is at stake in the ongoing debate over an alleged "crisis of values" in American higher education. What will educated citizens need to know if they hope to lead intellectually satisfying, morally responsible lives in the society of the future? And, given current trends affecting the American university, will it continue to play a major role in generating and disseminating this knowledge? The perspective suggested by these questions provides a basis for considering the goals that higher education might be expected to meet in the decades ahead.

Conflicts that beset the university today reflect tensions that exist in society at large. For example, higher education has traditionally been reserved for a social and intellectual elite. Even in America, the attempt to educate large numbers of students at the post-secondary level is a relatively recent phenomenon. In 1910 only five percent of college-age Americans actually attended institutions of higher learning. By 1987 that figure had risen to 62 percent. Because university degrees are now perceived as entryways to social and economic advancement, access to higher education has come to be regarded as the right of every person in a democratic society.

The American university has responded with remarkable success to the challenge posed by this assumption. The diversity and quality of higher education in the United States are unparalleled anywhere else in the world. Yet the democratization of the university has produced a tension between, on the one hand, the need to maintain standards that assure seriousness in the pursuit of knowledge and, on the other, the obligation to accept students who lack the preparation necessary to meet these standards. And this tension is being exacerbated by demographic changes that will significantly influence the university of the future and the nature of its mission in society.

In the first place, the ethnic composition of American society is changing. If the university is to assume responsibility for educating the citizenry of the future, it must discover ways of dealing with a population quite different from the one it has traditionally served. Recent immigrants and native-born minorities have frequently been ill-served by American schools and underrepresented at American universities; however, their numbers are increasing rapidly while the pool of white, native-born students of college age is declining. Father Theodore Hesburgh, recently retired President of Notre Dame University, suggested the magnitude of the challenge posed by this situation. "We are facing a baby bust among white native-born residents," he declared, pointing out that, if present trends continue, more than half the growing population of hispanic and black youth will drop out of school before mastering the most elementary intellectual skills. If nothing is done, Hesburgh continued, "one-third of the workforce will be functionally illiterate in a few decades." Much of the problem results from attitudes that characterize all segments of American society. Modifying such attitudes is crucial for the country's future, for, as he concluded, "solving the problem of racial inequity is the key to our economic and social well-being; we can't afford a social underclass anymore."[4] According to him, the university can play an leading role in this process by helping to eliminate racialist thinking and by finding ways to retain more minority students through the completion of a post-secondary education.

In the second place, universities are beginning to serve ever larger numbers of older, non-traditional students. In many post-secondary institutions, the pattern of four-year attendance by 18- to 22-year-old students is no longer the norm. At The Ohio State University, for example, the average age of undergraduate students had risen to 23.7 by the academic year 1986-87.[5] Up to 25 percent of the enrollment at some universities consists of older students returning to complete their educations for personal or professional reasons. In light of rapidly changing vocational and career patterns, this trend is likely to continue and even to accelerate. Non-traditional students often attend the university part-time or at night, and because the demands they place on the curriculum differ markedly from those of 18- to 22-year-old, full-time students, the university will have to reevaluate its programs if it hopes to meet the real needs of its changing student population.

Another consideration with which the university of the future must grapple is the relationship between education and wisdom. Contemporary society attaches great value to technological innovation and vocational preparation. Universities have responded by emphasizing their ability to disseminate knowledge and to impart skills or techniques. Wisdom, however, involves the capacity to judge how knowledge, skills, and techniques should be applied. It concerns itself with questions of meaning, value, and long-term goals in relation to individual self-realization and within the context of the general welfare in the society at large.

Traditionally linked with a profound humility in the face of mankind's inability to know everything, wisdom is grounded in an attempt to comprehend the nature and purpose of human existence. As such, it enables people to select what they need to know in order to attain the goals they have set for themselves; it permits them to establish the high level of civic discourse that is assumed to be at the heart of the democratic process; and it allows them to envision a moral order based upon critical reasoning rather than upon the passive acceptance of unexamined clichés, a moral order that reflects a genuine concern for others and for their environment rather than one that sanctions the unbridled pursuit of a narrowly defined self-interest.

The university of the future has a crucial role to play in preserving a respect for wisdom, which is, as Alfred North Whitehead once suggested, the humane mastery of knowledge. This role is essential in a society that defines itself in terms of shared assumptions about the capacity of all citizens to participate in the governance process. For American democracy to function properly, education in general, and higher education in particular, must do more than impart knowledge, skills, and techniques; it must inculcate each new generation of students with the desire to seek the wisdom that can liberate them from stereotyped notions and motivate them to apply what they learn in a morally responsible fashion.

One common approach to the definition of wisdom is to associate it with the traditional liberal arts core curriculum of the American university. William Bennett argues that higher education in this country has been seriously weakened by its failure to emphasize fundamental intellectual skills and by its neglect of generally recognized masterpieces in Western literature, history, and philosophy. According to him, the university has a moral obligation to familiarize students with these texts because a knowledge of them provides the American people with a shared set of cultural values and makes enlightened civic discourse possible. He also contends that, because these texts address problems of universal human concern, they are capable of honing the critical reasoning capacity of students and helping them define their place in society and in the world. He concludes that a firm grounding in the tradition represented by these texts should be a basic component of moral character formation in American democratic society.

The remarkable popular success of Allan Bloom's *The Closing of the American Mind* reflects a widespread general interest in the sort of university reform suggested by Bennett. Bloom's philosophy embraces analytical reason as the sole pathway to truth; it also espouses American democratic principles and family-oriented values as the best possible foundation for "the good life according to nature." Everything that Bloom cherishes was challenged by radical student movements and changes in the lifestyles of young people during the 1960s and early 1970s. His position was also menaced by new fields of inquiry that have emerged in recent years to focus attention on what had been neglected in the traditional curriculum: the experience of women and minorities, non-Western cultures, and non-analytical modes of understanding. In light of these developments, Bloom came to view himself as a spokesman for the embattled minority that was seeking to sustain the traditions upon which civilized society was supposedly based.

For this reason, he attacked the "openness" that treats the new disciplines, lifestyles, and modes of thought with the same intellectual seriousness that had once been reserved for the traditional values with which he identifies. Such "openness" is dangerous, he contends, because it culminates in a refusal to regard these values as superior to any others. "We are like ignorant shepherds living on a site where great civilizations once flourished," he asserts at one point. "The shepherds play with the fragments that pop up to the surface, having no notion of the beautiful structures of which they were once a part. All that is necessary is a careful excavation to provide them with life-enhancing models."[6] For him, then, higher education should be like an archeological dig, a recovery of what has been thought and said during the past in the students' own culture. Such an approach to higher learning would, he is convinced, reawaken students to an appreciation for the aesthetic qualities of universal truth as Bloom perceives it; it would also restore analytical reason to preeminence in the college curriculum, reestablish common ground for a viable national identity, and enable students to live fuller lives by defining themselves in relation to their cultural heritage.

Bloom is certainly justified in lamenting a general lack of familiarity with classical texts in the Euro-American tradition, a widespread unwillingness to engage in rigorous critical thinking, and the trivialization of life encouraged by many forms of popular culture; however, his blueprint for higher education is incapable of sustaining the quest for wisdom in the modern world. The canonical texts he places at the core of the university curriculum have acquired meaning and value within a specific historical context, and they are part of a cultural heritage that must be preserved as part of our collective identity, but they cannot adequately represent the complex interdependencies that characterize the world today and, for that matter, have done so throughout much of its history.

Yet Bloom's attack on current trends in higher education does raise an important question: how can we allow everything to be studied equally and in many different ways while still maintaining the ability to judge, to evaluate, to discriminate--an ability that has always been vital to the humanities as they are taught at American universities? To answer this question, we must consider the types of complexity we will be obliged to confront in the world of the future.

Our world is complex in the sense that diverse human societies have generated a multiplicity of cultural models. In many of them, individual and collective motivation may derive from assumptions we do not share. If we desire to avoid conflict and to engage in meaningful dialogue with people from these cultures, we will have to make an effort to comprehend their motivations, and this can be done only if we are aware of their cultural assumptions. Furthermore, the discovery of the other, the exotic, and the strange can serve as a vehicle that opens our minds to a deeper understanding of ourselves.

Our world is also complex in the sense that it is an intricate web of interrelated phenomena. Acting upon one part of this web will have consequences for other parts as well; the Euro-American cultural heritage and an analytical rationality can profitably be complemented by non-Western and non-linear modes of thought as we seek to deal responsibly with such complexities. In other words, if students are to acquire wisdom for living in a culturally and ecologically complex world, they must become familiar with far more than what critics like Bloom and Bennett are prescribing in the curricula they are proposing for the university of the future.

The recognition of perspectives previously ignored in the Western tradition (e.g., those of women, minorities, and people from other cultures) marks the emergence of a new wisdom characterized by an awareness of complexity and a humility with regard to the human incapacity to know everything. It also takes more seriously the plurality of voices to be heard in Americans' "own" culture.

There are a limited number of fundamental questions that confront all people everywhere, such as, Who am I? What exists? How do I know what I think I know? What does it mean to be fully human? What should a good person do? What is the meaning of life in the face of death? Is there a common or shared humanity? It is of course possible to ignore such questions, but to do so would be to renounce one's capacity for self-conscious reflection. Because Plato and Goethe, Dante and Shakespeare, Rembrandt and Beethoven addressed such issues in insightful and aesthetically pleasing ways, exposure to their works can help students comprehend these fundamental questions and begin to think seriously about them. But these questions have not been answered once and for all time in any list of great masterworks; on the contrary, they must constantly be redefined and reexamined in light of changing circumstances and new knowledge.

The spirit behind a truly liberal education is thus not a blind adherence to values embodied in cultural artifacts from the past, but rather a desire to comprehend such values within their context and to evaluate their relevance to our own perceptions of reality. It is concerned less with the practical means of achieving specific objectives than with the question of whether or not such objectives are worthwhile and compatible with one's own principles. A truly liberal education does not make people comfortable, for it prepares them to challenge received ideas and to reinterpret the classical texts in their own cultural heritage.

A number of authors in this volume have defended this conception of liberal education on moral, intellectual, and pragmatic grounds. Charles Odegaard has argued persuasively that this kind of education should be an integral part of every physician's professional training. Like all other citizens, physicians should, he explains, have an informed perspective on the world, and the university has an obligation to help them articulate it. According to Odegaard, this perspective ought to include a recognition of their duty to become aware of themselves and others as persons, to act responsibly in society and toward the environment. Ever since the Flexner report in 1911, however, medical schools have tended to emphasize technical and scientific training to the exclusion of any serious consideration of the issues raised in a truly liberal education.

This rift between what should be complementary aspects of a physician's preparation to treat illness under real-life circumstances is exacerbated by the split between what C. P. Snow once called the culture of science and the culture of the liberal arts. As the language spoken by scientists became less and less comprehensible to humanists and as the concerns of humanists became increasingly divorced from the practice of science, two communities emerged in the university. Although sensible solutions to major problems require the expertise of both, members of one community frequently ignore relevant information that might have been provided by people from the other community. The result is not only the individual's loss of potential for a fuller and richer life, but also disastrous decisions that could have been avoided if all educated citizens had been given access to the knowledge of both communities.

Odegaard is convinced that Snow's description is as applicable today as it was 25 years ago. In an era when many people attach greater value to things than to other people, Odegaard feels that the scientific-technical bias of modern medical education often inhibits physicians from acquiring the concern for larger issues and the humanistic ways of thinking necessary for the successful, ethically responsible treatment of patients as persons. He suggests that this situation can be improved if medical schools develop ways of providing their students with a liberal education that allows them to integrate their specialized technical knowledge into an informed perspective on the world. What Odegaard says about medical education is also true of professional education in other fields, for as he himself points out, the goals and values of an educated citizenry are simply not addressed in wide reaches of the modern university. His proposal to humanize professional education at the university of the future can thus be seen as a means of fostering self-realization among individuals and as a contribution to the emergence of a saner, more cohesive society.

Habits of mind associated with the traditional liberal arts core curriculum have also been defended by representatives from the business community. Andrew Wolf contends, for example, that successful corporate leaders need the ability to think in terms of larger issues than technical feasibility and short-run profitability; they should also have the flexibility to cope with changing situations in which new skills and modes of thought must be acquired. Because these are precisely the qualities that a liberal education promotes, Wolf contends that the self-interest of American business will best be served by investing substantially in it.

In fact, he is convinced that the best hope for the future of higher education lies in the formation of "dynamic alliances" between universities and corporate America. During the 1970s and early 1980s, more and more students enrolled in business-related degrees and neglected the traditional liberal arts offerings that, according to Wolf, future corporate leaders need most. Although this trend has already begun to reverse itself, he believes that much remains to be done. One approach to this problem has been developed by the Corporate Council on the Liberal Arts, which has set out "to effectuate a policy model whereby a liberal education is viewed as the principal instrument for a way of thinking about the large world and about the essence of what human possibility, human personality, and human competence might become in our social order." Designed to reverse the trend away from the liberal arts in the university, this model benefits the business community by supplying it with broadly educated individuals who are capable of comprehending larger issues and responding appropriately to them. In return, the business community is invited to provide financial support for the implementation of the model.

Wolf's contention that liberal education enhances a prospective business leader's capacity to cope with change is equally applicable to students preparing to enter other professions. As Stephen Toulmin points out, global shifts in industrial activity "deal a deathblow to the idea of training for a whole lifetime. That's why a university education has to be a general education rather than vocational training. The chances are that whatever industry you go to work in when you leave college won't exist twenty years later. If you turn out people with structured sets of skills they don't know how to modify, you've done them a disservice."[7]

The utilitarian rationale for retaining the liberal arts at the core of a university education is thus based primarily upon their capacity to focus attention on larger issues and to foster habits of mind that allow people to devise new strategies for coping with changing circumstances. It is undoubtedly for this reason that liberal arts requirements are becoming increasingly common in professional and pre-professional programs at universities throughout the country. Yet the most important justification for this sort of study may not be utilitarian in the sense suggested by Wolf. For by awakening in students the desire to pursue wisdom and to act in accordance with it, a liberal education becomes its own reward, enabling people to live in harmony with themselves, with others, and with the world around them.

If liberal education is to function in this way, however, it must embrace new paradigms of knowledge and not allow itself to be defined solely in terms of what has been taught in the past. Germaine Brée points out that some of the modern university's most prominent features are rooted in the Middle Ages. These features have lent it a more or less coherent identity through time, but when they become dysfunctional or incapable of accommodating new knowledge, Brée feels they should be reexamined and adapted to changing circumstances. The impulse for innovation has often originated with students rather than with faculty members, who tend to identify with traditional institutional structures; for example, many communal, performance-oriented activities have resulted from student initiatives, and new disciplines like women's studies have arisen out of an ongoing dialectic between students and faculty members.

The emergence of women's studies illustrates, for Brée, the value of this openness. Now for the first time, the majority of university students in this country are women. As they become increasingly aware of the roles to which women have been relegated in the past, these women will begin to challenge the standards of taste and judgment that dominate Western society. And such a challenge obliges people to recognize the inadequacy of stereotyped notions that had previously been accepted without question. Women's studies has thus succeeded in doing precisely what a liberal education is supposed to do; it has called unexamined assumptions into question and provoked students into articulating their own perspectives on the world.

On the basis of such experiences, Brée is convinced that the university of the future must remain responsive to the aspirations of students and not merely insist upon subjecting them to a standard curriculum of Western classics. In an era when the major purveyor of culture has become the mass media with its mind-deadening consumerist ethos, the most important task for the university of the future will be to keep alive the students' capacity to experience the joy of discovery, to reexamine the enduring questions within relevant contexts and in relation to new ways of knowing. It can no longer afford to be a cloistered sanctuary, for it is already being called upon to grapple with a wide range of social, scientific, and ethical issues that are inadequately represented in the traditional Western canon, and higher education's changing clientele will undoubtedly demand new definitions of the culture that should be transmitted from one generation to the next.

Even on the most pragmatic grounds, education for cross-cultural understanding makes sense. "We will need to understand many non-English-speaking countries that will make a difference in the next century," points out John Silber, and "cadres of people [must be] trained to understand these countries."[8] The study of foreign languages will obviously constitute a crucial part of this training. People will also need to know about the cultural contexts in which these languages are used. If the cadres mentioned by Silber are to be effective, however, our entire society must become more willing to regard people from other cultures as equal partners in a mutually beneficial dialogue. This respect for "otherness" can only be cultivated by making people aware of how other cultures function, and the university of the future has a central role to play in bringing about such an awareness.

This awareness presupposes a global approach to knowledge. Unfortunately the contemporary university has manifested a strong tendency toward fragmentation and segmentation. For the university of the future to be successful in helping students articulate a viable perspective upon the world, it will have to reverse this trend and promote a new synthesis of the old and the new, the scientific and the humanistic, the artistic and the technical. "All knowledge is one," asserts Kenneth Keller, paraphrasing John Dewey. "Its division into subjects is a measure of human weakness." Breaking up reality into isolable fragments has enabled people to solve many concrete problems; but as Keller points out, the task of putting the fragments back together has often been overlooked. According to him, the real challenge for the university of the future entails the establishment of deep connections among phenomena that are presently being studied separately in different disciplines. Admitting that every point of view is limited and partial, he nevertheless believes that sound decisions can be made if the best available information is brought to bear on them. In order to gain access to this information, he proposes that the university become a genuine community of scholars who willingly engage in cross-disciplinary activities.

Within the context of imagining a core curriculum for a truly liberal education in the university of the future, Keller is convinced that one cannot simply return to the values and cultural assumptions of the past. On the contrary, one must develop an intelligent, integrative approach to the present state of knowledge in all fields. A scrupulously faithful transmission of the Euro-American heritage cannot, according to Keller, provide an adequate unifying focus for the university of the future. In his opinion, the lack of coherence in today's university curriculum has resulted from allowing it to be influenced haphazardly by issues that affect society in important ways. To place these issues in perspective, he concludes, the university of the future needs an integrated conception of what it hopes to accomplish, a coherent idea of what every educated person might be expected to know. Based on global thinking and a respect for new knowledge, such a conception could serve as the unifying principle behind a relevant, modern curriculum capable of providing a truly liberal education for the broad range of students it will be asked to serve.

However, the dominant activity in the university of the future may well not be the teaching of undergraduate students but the conducting of advanced research. Since the Second World War, the federal government has been the major outside funder for scientific research at American universities. Within recent years, private industry has vastly increased its support for university research, and state governments are beginning to view major universities as sources of economic stimulation and growth. Such funding patterns and the priorities they imply have important ramifications for the university of the future. They have already altered traditional assumptions about the nature of the university, and they are gradually bringing about a redefinition of its mission. "Engineering and science are merging," points out Lewis Branscomb, "for as the methods, tools, and questions in many fields of engineering become more like those in related fields of scientific research, university science becomes increasingly relevant to industrial and government needs."[9] In response to this situation, universities are now actively pursuing industrial research funds, rethinking their policies on patents and licensing agreements, and establishing research parks to facilitate the flow of new knowledge into marketable technology. Precedent for such developments has been found in the land-grant institutions with their emphasis upon applied research and public service, but the magnitude of new funding possibilities and their relation to commercial or military purposes have changed universities in ways that would have been unimaginable 50 years ago.

Many administrators regard these changes in a favorable light. Silber, for example, considers them as part of a natural evolutionary process during which universities will increasingly assume responsibility for research and development that has traditionally been carried out in corporate laboratories.[10] Edward Jennings argues that private sector support is one of the ingredients that will make the comprehensive public university the dominant form of higher education in the United States during the twenty-first century. Land grant institutions, he points out, have the financial resources and the broad spectrum of technical expertise to support the interdisciplinary research that is now at the forefront of scientific innovation, precisely the sort of research that interests private corporations. In part through collaboration with industry, the large public universities will, he believes, enhance their capacity to undertake important scientific research. Such trends will in turn attract greater numbers of graduate students to these universities, which already award more than 60 percent of all doctorates in the United States. For this and other reasons, Jennings expects the university of the future to place even greater emphasis upon research and to work more closely with private corporations, a development he does not see as detrimental to the teaching mission of the university. On the contrary, he believes it will help the university attract talented undergraduates and maintain a cost structure that will assure access to higher education for most Americans.

In recent years, federal and state funding of university research have often been justified as an efficient way of improving national or regional economic competitiveness. Within this context, agencies at all levels of government have established channels of communication between researchers in industry and those at the universities. According to Branscomb, the weak link in this government-industry-university alliance is the inattention paid to production engineering. The higher priority placed on the process of manufacturing in Japan, he says, naturally leads to cheaper, better quality products that are highly competitive on world markets. In the United States, he believes that the bias against production engineering is reinforced by the fact that students are often being taught by faculty members who depend largely on funding from NASA or the Department of Defense, neither of which has any particular interest in efficient manufacturing because they are primarily interested in custom-built items designed for maximum performance. "We need to revolutionize engineering education," Branscomb declares, "for only by focusing upon the manufacturing process and attracting talented individuals to work in the field will the United States be able to compete successfully with countries like Japan in world markets."[11]

One prerequisite for the success of such a program is the relaxation of disciplinary boundaries that inhibit the intellectual cross-fertilization necessary to creative thinking in science, technology, and the liberal arts. At the University of Sussex in England, Asa Briggs established "schools of studies" as opposed to departments, which he regarded as obstacles to the acquisition of knowledge and to the flexibility that fosters insight and innovation. Many scientists are now advocating interdisciplinary research as the most promising avenue to new developments. "If universities continue to block it by the ways they are organized and by the ways they operate," declares Branscomb, "we will need new interdisciplinary research centers set up outside universities."[12] As a possible model for this kind of work, he cites physicist Murray Gell-Mann's proposal for the Santa Fe Institute, a post-graduate research center without departments.

This proposal and others like it illustrate an awareness of the need to develop modes of perception that respect the connections among phenomena commonly viewed in isolation. Such proposals also testify to a growing willingness to recognize the fruitfulness of bringing a multiplicity of disciplinary perspectives to bear on the same sets of problems. Computer graphics and artificial intelligence illustrate how interdisciplinarity can lead to significant breakthroughs in our understanding of our world. As Charles Csuri, Lynn Cooper, Franklin Roberts, and others have demonstrated, it is now possible to create hypothetical realities and to manipulate them in ways that were inconceivable 20 years ago.

One side-effect of viewing university research as a source of economic competitiveness has been a growing tendency toward what Branscomb calls "intellectual protectionism"--the desire to prevent foreign scientists from gaining access to research with potential commercial applications. Coupled with the secrecy that surrounds research conducted under contract with the Department of Defense and other federal agencies, this tendency has serious ramifications for the freedom of intellectual exchange that has traditionally characterized university research. Branscomb cites a case in which a Caltech professor attempted to block a Japanese citizen from enrolling in a course on integrated circuit design. Although this situation appears to have been unique, intellectual protectionism poses a significant danger to the future of academic research. For example, Branscomb points out that the national laboratories are a major resource for industrial technology work, and they can exclude foreigners. "We may see pressures to take leading technical activities from universities and give them to the labs," he reports. "This kind of intellectual protectionism would leave universities irrelevant when it comes to new technology."[13]

To forestall such developments, Branscomb feels that Japan in particular must be persuaded to grant freer access to the advanced scientific research that is being carried on there. As he realizes, however, such work is generally conducted by Japanese industry and not in the Japanese universities, which remain extremely open in most respects. In the long run, if the United States succumbs to a mood of intellectual protectionism, Branscomb feels that the results will be more harmful than beneficial to the country because such attitudes stifle the free flow of information that helps produce a vital research community. Besides, he knows that American competitiveness depends more on what Americans do than on what they can prevent the Japanese from doing.

David Riesman is also emphatic on this point. "We don't need protection," he claims. "We need to compete the way we always have--by doing the research to stay ahead and by getting that research into attractive products."[14] He adds that American universities have an important role to play in this process, for they have the resources to teach the citizens of the future what they must know in order to compete in world markets. Hesburgh goes even further when he declares that the university contributes to the American competitive position primarily by providing industry with people who recognize the value of work and comprehend the complexity of the world in which they are living.[15] In other words, he is once again emphasizing the university's responsibility to help create a liberally educated, technically skilled citizenry.

In addition to a growing interest by industry and government in the results of academic research, there is a growing tendency for both public and private sectors to rely upon universities to provide courses, particularly technical courses, for the professional development of their employees. Private industry alone, reports Branscomb, "spends about 100 billion dollars a year on mid-career education, mainly at universities; IBM itself spends two billion."[16] However, as in the area of advanced research, large firms have not always been satisfied with the returns they have received from this form of investment. As Diether Haenicke points out, "corporations themselves are going heavily into the business of teaching. They think they can focus more sharply on what they need, [and] this will draw resources away from universities."[17] The interactive satellite television courses offered by the National Technical University (a Colorado-based consortium of nineteen universities) and the successful real estate curriculum at New York University demonstrate the strong demand for professional enrichment programs, but Haenicke's comment suggests that alternative institutions might well arise to meet the instructional needs of our society if the university of the future fails to do so.

Even if corporate and federal funding remains at a relatively high level, its impact on the university may not be entirely positive. The implicit and explicit conditions attached to such funding often alter the university's traditional role in education and basic research. Dorothy Nelkin indicates that present funding practices have already affected the sorts of research undertaken in today's universities. In 1985 the National Science Foundation provided more than a billion dollars for research at American universities, and the Department of Defense contributed almost as much. Although corporate funding for university research increased fourfold between 1973 and 1983, it still amounted to only $370 million in the latter year.

Yet, as Nelkin explains, when federal funding agencies place top priority on large-scale engineering research centers that develop commercially exploitable innovations and when government at all levels regards the university as a means of strengthening the competitiveness of industry, the orientation of university-based research shifts from the disinterested pursuit of knowledge toward the search for practical applications. Riesman suggests one of the ways this danger may arise. "By focusing on applied research, we could lose the broader benefits of basic research," he says. "The patient clinical researcher, for example, may lose support, while a biotechnology guy who promises commercially valuable results in the near future gets all the funds."[18] This skewing of priorities might not be in the long-term interest of society. In any case, it threatens values traditionally associated with university teaching and research.

The greatest danger may well be, as Ernest Boyer claims, that the university will "offer whatever is wanted" in order to "accommodate customers."[19] One of the guarantees frequently demanded by government and private sector customers is the intellectual protectionism decried by Branscomb. Whereas autonomy and the informal exchange of information have characterized university research in the past, much work presently being done for large corporations and for the military is, as Nelkin demonstrates, rigorously controlled from the outside and shrouded in secrecy. Agreements are signed to delay the publication of research findings, impeding the free flow of scientific knowledge and preventing scientists from speaking publicly about the social and moral implications of their work.

Furthermore, the pursuit of outside funding often predisposes universities to make decisions that are not in their own long-term self-interest. Faculty members are hired according to the availability of funding and not on the basis of students' educational needs. Public relations campaigns exaggerate the anticipated short-run benefits of university research, and the purchase of expensive equipment has made many institutions vulnerable to abrupt changes in funding patterns. In any case, "universities may have too high expectations about the volume of support that will be forthcoming from such relationships," warns Hanna Gray,[20] and the public may lose confidence in universities if people fail to see substantial improvements in local employment conditions or in the competitiveness of nearby industry.

If a commercial, overly competitive atmosphere poses dangers for scientific research in the university of the future, its effects will also be apparent in the revenue-producing athletic programs presently associated with most major universities. The financial rewards of athletic participation can be enormous both for the individuals who later sign remunerative contracts with professional teams and for the universities that collect millions of dollars in gate receipts, television revenues, and licensing agreements. However, a high price is paid to generate this income. Not only is attention diverted from the university's primary missions in society; there is also an enormous waste of human potential among athletes who never obtain the material rewards to which they aspire.

For example, increasing numbers of athletic scholarships at major universities are awarded to Blacks. In some ways, this situation represents an opportunity for Black Americans to acquire an education and to improve their social status, but sports sociologist Harry Edwards argues that it is actually a new form of exploitation that reserves power and authority for Whites while it condemns the vast majority of Black athletes to lives of frustration and futility. Because many young Black people are convinced that their only hope of success lies in the area of professional athletics, they devote enormous amounts of time to honing skills that are useful only on the playing fields, and they neglect educational opportunities that might equip them for other kinds of success in American society.

Major universities recruit Black athletes because the financial rewards of intercollegiate athletic success are great and Black athletes are now necessary to achieve success in this area. Within 7 to 10 years, Edwards predicts, football and basketball teams at major American universities will be almost entirely Black. Already the majority of all football and basketball scholarships at such schools are awarded to Blacks, and 80 percent of the starting squads in these sports at the top 20 schools are Black. Yet most Black athletes fail to benefit from this system. As Edwards reports, more than 70 percent of all Black athletes who enroll in college never graduate. Less than 2 percent of college athletes ever receive a professional paycheck, and 60 percent of those who do will remain in the profession only for 3 or 4 years. In other words, the probability that any given Black youth will attain wealth and status through athletic competition is ridiculously small.

Nevertheless, tens of thousands of Black young people pursue the myth of success through athletic prowess, and their families encourage them. The psychological cost of failure is high, and it is paid by all those whose creative energies are channeled into the pursuit of a chimeric dream. To avoid being exploited in this manner, Edwards concludes, Blacks must repudiate the myth of success though athletic competition and focus more upon the development of their own capacity for intellectual and social accomplishment. At the same time, universities have an obligation to scrutinize the role they play in supporting subtle forms of racial injustice; even more important, they must redefine the relationship between intercollegiate athletics and their own primary mission as institutions of higher learning.

No one can know with certainty what the university of the future will look like, but one can have some idea of the challenges it must confront and the alternatives it will have the opportunity to consider. In the twentieth century, the American university has successfully provided post-secondary education for unprecedented numbers of people while it has participated prominently in the generation of new knowledge and kept alive the cultural heritage it is charged with preserving. As David Gardner says, "the American university is . . . a uniquely resilient institution with a remarkable capacity to adapt, absorb, and endure."[21] One reason for this resilience is its openness to self-questioning and dialogue. Ernest Boyer has spent many years studying American universities, and he contends that they "undergo greater and healthier self-examination than any other institution I can think of. . . . The result is a process of self-renewal."[22] The various points of view presented in this volume illustrate the vigor of the self-examination process and the promise it holds for the university of the future.

Like all publishing ventures, this one has resulted from a collective enterprise. We wish to thank Ella Kirk, who was our symposium coordinator; Marguerite Oleiki, who helped with the original word processing; and Diana Phillips, whose editorial assistance has been crucial to the final production of this volume. As always, our appreciation goes to Brenda Hosey, the Center for Comparative Studies' administrative assistant, without whose careful management none of our projects would come to fruition. Finally, we wish to express our profoundest gratitude to Dean G. Micheal Riley and the College of Humanities for their foresight in supporting the symposium from which these essays were drawn, and to express our appreciation for a special publication grant provided by the Office of the President of the Ohio State University, Edward H. Jennings.

Notes

[1] See Association of American Colleges, *Integrity in the College Curriculum* (Washington, D. C.: AAC, 1985); National Endowment for the Humanities, *To Reclaim a Legacy* (Washington, D. C.: NEH, 1984); National Institute of Education, *Involvement in Learning: Realizing the Potential of American Higher Education* (Washington, D. C.: NIE, 1984); National Commission on the Role and Future of State Colleges and Universities, *To Secure the Blessings of Liberty* (Washington, D. C.: American Association of State Colleges and Universities, 1986); and The Carnegie Foundation for the Advancement of Teaching, *College: The Undergraduate Experience in America* (New York: Harper and Row, 1987).

[2] Among the most prominent books in this category are Allan Bloom, *The Closing of the American Mind* (New York: Simon and Schuster, 1987); E. D. Hirsch, *Cultural Literacy: What Every American Needs to Know* (Boston: Houghton Mifflin, 1987); Howard Bowen and Jack

Schuster, *American Professors: A Natural Resource Imperilled* (New York: Oxford University Press, 1986); and Russell Jacoby, *The Last Intellectuals: American Culture in the Age of Academe* (New York: Basic Books, 1987).

[3] "The Educated Citizen and the University of the Future," The Ohio State University, Columbus, Ohio, May 6-9, 1987. Unless otherwise indicated, all quoted remarks were made during the colloquium.

[4] Father Hesburgh, former President of the University of Notre Dame, made these comments in a telephone interview with Duncan Brown on April 22, 1987. In conjunction with the "University of the Future" symposium, Brown conducted a series of ten interviews with leading educators to ascertain their views on the issues being discussed at the symposium.

[5] Ohio State Annual Statistical Summary, 1986-87.

[6] Bloom, *The Closing of the American Mind*, p. 239.

[7] Stephen Toulmin, Professor, University of Chicago, interview with Duncan Brown on April 28, 1987.

[8] John Silber, President, Boston University, interview with Duncan Brown on April 18, 1987.

[9] Lewis Branscomb, Professor, Kennedy School of Government; former member, Corporate Management Board, IBM Corporation, interview with Duncan Brown on April 13, 1987.

[10] Silber, interview with Duncan Brown on April 18, 1987.

[11] Branscomb, interview with Duncan Brown on April 13, 1987.

[12] Branscomb, interview with Duncan Brown on April 13, 1987.

[13] Branscomb, interview with Duncan Brown on April 13, 1987.

[14] David Riesman, Professor Emeritus, Harvard University, interview with Duncan Brown on April 19, 1987.

[15] Hesburgh, interview with Duncan Brown on April 22, 1987.

[16] Branscomb, interview with Duncan Brown on April 13, 1987.

[17] Diether Haenicke, President, Western Michigan University, interview with Duncan Brown on April 13, 1987.

[18] Riesman, interview with Duncan Brown on April 19, 1987.

[19] Ernest Boyer, President, Carnegie Foundation, interview with Duncan Brown on April 14, 1987.

[20] Hanna Gray, President, University of Chicago, interview with Duncan Brown on April 17, 1987.

[21] David Gardner, President, University of California, Berkeley, interview with Duncan Brown on April 23, 1987.

[22] Boyer, interview with Duncan Brown on April 14, 1987.

Between the Old and the New: The University of Today and the University of Tomorrow

Germaine Brée

How can we prepare our students for a world whose shape we can only vaguely discern, from the vantage point of a constantly moving present that is always hard to decipher? In my experience, the future, when it became the present, was never what it had been projected to be, nor what it turned into when we looked back at it as past. Yet this is the very reason why the question must be asked. As we reflect on the university of the future, we would also be well advised to ask ourselves exactly what we mean by the word "university."

I speak as a professor who has taught for 50 years in American colleges and universities and who is a firm admirer of the diversity, vitality and flexibility of the American network of institutions of higher learning. I was educated in an English school, went on to a French university, then to a year of graduate study at Bryn Mawr College. For me, the American academic system has probably been, in the last 50 years, the most powerful center of that intellectual energy which empowers the activities of universities the world over. A world-wide range of academic exchanges is one of the more exciting developments I have witnessed over the years. Not only can we move, in our own country, from one university to another. But, with the help of organizations that have often been founded here, students can cross the boundaries between countries. Besides the traditional exchanges with European countries and Canada, exchanges are taking place everywhere between students and faculties (Russia, Japan, China, Korea, Africa, Australia, South America...). Who among us has never lectured in universities abroad? Participated in international conferences? Contributed to international journals in our disciplines? Besides my somewhat cosmopolitan education, I have myself taught in Algeria, at the American University in Cairo, the University of Adelaide in S. Australia, and King's College in London, to say nothing of a variety of colleges and universities in the U.S.A. This remark is intended merely as a way of setting a concrete context for what follows. It underscores one of the characteristics of university life today. Consciously or not, it cannot but be international in outlook. A second feature is more specifically connected to our development as a nation: the determination to educate a mass of people up to whatever level they can reach. But this too is becoming a wide-spread aspiration, albeit an unrealizable one for many nations. This situation is changing our notion of "the University" somewhat.

Before looking forward, I would like for a moment to consider the studies of medieval scholars like Professors Haskins and Le Goff, who describe the emergence of the first European-style universities between the twelfth and fifteenth centuries in response to an explosion of new knowledge. Both stress the fact that, as far as their basic structure is concerned, our universities have not changed much over the centuries: division into faculties according to disciplines, a hierarchical master-student relationship, fixed periods of study comparable to the quarter-system, a required syllabus of basic texts commented upon by masters in lecture periods and on which students are examined, the culmination of this process in the granting of degrees by means of which the student becomes a master, and the ritual of commencement and gown. Throughout its early history, the university stubbornly defended certain privileges that defined its transnational autonomy and the domain of its (essentially clerical and church-related) power. This is admittedly a quick sketch. Today we have some difficulty in defining the nature and boundaries of our own authority because universities have taken on broad and diverse tasks--from basic instruction to graduate education. To "transmit" a body of knowledge and to prepare teachers to carry on that task is only *one* of our goals. Our stubborn struggle for freedom from outside pressures, whether political or societal, asserts a belief in intellectual integrity which we have not as yet clearly defined. The rapid development of new disciplines, new methods, new distributions, new institutional functions has often distanced us from a disconcerted public. We can, with some justification, compare our university system today to the good ship Argo: as it sailed the seas, all its parts were replaced, but the overall entity known as the "Argo" still remained.

In our own period, which is itself marked by an "unprecedented explosion of knowledge," we are struggling with the fact that institutions of higher learning have outgrown certain structures that are still in place. This situation may account for what the Reverend Hesburgh has diagnosed as a sense of rootlessness in our academic life. Hence the successive waves of debate and recrimination that break over our heads, somewhat uselessly. The words crisis, danger, peril somewhat recklessly suggest the kind of hysteria apparent in other realms: Apocalypse, Armageddon. If we do indeed succumb to the nuclear peril, the blame cannot be laid at the door of our educational institutions, except as an evasion of individual civic responsibility.

Nonetheless, there is a feeling of uneasiness in our midst concerning the academic system of which we are a part. The overly dramatic views so liberally publicized tend, it seems to me, to obscure the more reasonable assessments of the situation. We know we are living in an era of rapid change that is shaping new modes of life right under our eyes. Blocks of obsolescent industries "crack and crumble"; complex "forms of electronification" take over. Throughout the world people are on the move in one of the biggest migrations ever, whether because of famine, wars, or mere tourism. Nations struggle vainly to close their frontiers. New patterns cannot be forced into old frames. Hence in part the sense of "rootlessness." Whatever the nature of our dissatisfaction with our academic institutions, we should not forget that no other institution has responded to it so promptly--too promptly sometimes--as academia in the United States.

Going back to my image of the Argo, perhaps the various would-be reformers of our system could be roughly classified as (1) those who propose to return to the so-called "traditional" uniform structures of the curriculum; (2) those who merely "tinker" with them; (3) those who wish to transform them. No one, to my knowledge has proposed to do away with the entire edifice as it stands today. I wish to recall here some recent suggestions: William Bennett's controversial *To Reclaim a Legacy* and the American Association of Colleges' report on *Integrity in the College Curriculum*.[1] These reports tend to begin with a wholesale indictment of what "the university" is doing, occasionally--as in the case of the first--with a suggestion that change is being advocated out of a kind of moral perversity. But the two reports then move in opposite directions. The Bennett report sees the "educated person" one who has a university education, as a member of a community, fashioned in the past, defined by a familiarity with traditional texts that have been read in common. The argument of the report runs as follows: if we are to build a community that holds together, we must impose on students a common intellectual and ethical outlook that would bond us as citizens to each other in the understanding of what our world is about. This has long been the function of the liberal arts undergraduate curriculum, which has unfortunately been neglected. In other words, our curriculum has become so fragmented that we are like the man who stopped reading because he had "lost the narrative line" in the book he was reading--an encyclopedia. The remedy proposed by the report is to impose a common "canon," an institutionally sanctioned, authoritative list of books, on all students. But the question arises as to who does the selecting and what the list excludes. In the nineteenth century, the notion of a canon was formulated by academics. The danger of this approach is aptly illustrated by an episode that took place at the dawn of another historical era. You may remember the famous passage in the eighth book of *The Confessions*, when Augustine is recalling a moment of crisis in his life and a voice "reaches [his] ears," repeating: "take it and read it." The Book which then changed his life was precisely one that was not in the cultural "canon " of the young African from Carthage. It was the Bible.

In contrast, the AAC report insists on the multi-cultural, multi-racial composition of our student body and raises the issues of how "paradigms" (the available frameworks we use to organize our "fields") tend to exclude precisely those perspectives that open up new vistas, new possibilities. This seems to me the most fruitful direction for our thinking to take. Ernest Boyer's undogmatic approach in *College: The Undergraduate Experience in America* and Susan Van Dyne and Marilyn Schuster's article "Transforming the Liberal Arts" are extremely useful in this regard.[2]

Actually, the "university of the future" is already in the making as specific universities undertake to review the structures of their educational programs: Harvard, Stanford, Ohio State. Change in institutional structures is slow and entails a difficult process of thinking one's way through a corpus of questions. The enterprise must be collective, based on the reality confronting the faculty, students, and administrations involved. *Teachers for the 21st Century* is an interesting report, but the title is misleading insofar as it suggests that the turn of the century will, *ipso facto*, bring something new.[3] This is a rhetorical ploy. Centuries are convenient classifiers, not boundaries.

In many respects we are in fact undergoing change at a more or less rapid pace. Let us look at our student body for instance. Surely it is one of the principal elements in our conundrum: "For the first time in history women now present the majority of the college population and by the end of the century (i.e., a little more than 10 years from now) more than 30 percent of the college-age students will be members of so-called minority groups--'minority' be it noted, only within our borders."[4] The curriculum has begun to respond to these changes. While academics--mostly male--argue about the value of these new courses, they are there--30,000 women's studies courses, 452 official women's studies programs, 40 centers for research on women already in 1985. It is the same for comparative studies programs, for African or Black studies programs. The question then is not whether we should accept such changes but how to integrate them within a new educational frame. I agree with Van Dyne and Schuster that this can only be done by teams of competent scholars working from within each institution and with the cooperation of the administration; these scholars must be well-informed about what is going on elsewhere--from "prestige schools" to community colleges--and they must recognize that they are involved in a slow process that is not necessarily detrimental to the standards of performance within the student body.

There is another factor to be considered. For the first time in recent history we are not the only purveyors of knowledge for our students. The media give them a non-stop, multi-faceted, dramatic view of a culture mostly projected in terms of success, money, and food, but it is also accompanied by concrete, global pictures of the world in which they are living, a context that is often not provided for them by the university. Sooner or later we will have to accept the responsibility for correcting and rectifying this image of the world. Then too our students have sometimes stepped into the picture as actors belonging to another collectivity--particularly in actions such as "Hands Across America," "March for Peace," and "We Are the World." The collectivity here is not the university bounded by its campus. In fact, the university as an institution has often held itself aloof from such movements. Perhaps our programs have become too abstract, bracketing off questions of human meaning and significance.

In the university of the future, many of the questions we are now posing will become clearer as old boundaries cease to function as dead ends. In this respect, the restructuring of graduate studies programs and the methods they employ would seem to be particularly important. As teachers, it is our task to distinguish from among the questions we propose for graduate students to explore (or, more validly, from among those they themselves wish to study), those that are valid, within what framework, for what audience. The question for some graduate students today, particularly in the humanities, is: why do it at all? What are the alternatives? Tradition is not necessarily the only alternative to change, and, conversely, all change is not significant. In the varied institutions we subsume under the term "university," a number of solutions will arise in response to the diversity of needs within the vast frame of our educational undertaking. "In absolute isolation," D.H. Lawrence remarked, "I doubt that any individual amounts to much"; nor, I should add, remembering Virginia Woolf's ironical depiction of Oxbridge, would any university group ensonced within its academic precincts and the "golden age" myth of its indispensability.

Notes

[1] William Bennett, *To Reclaim a Legacy* (Washington, D.C.: NEH, 1984); Association of American Colleges, *Integrity in the College Curriculum* (Washington, D.C.,: 1985)

[2] Ernest Boyer, *College: The Undergraduate Experience in America* (Princeton, NJ: Carnegie Foundation, 1986); and Marilyn R. Schuster and Susan R. Van Dyne (eds.), *Women's Place in the Academy: Transforming the Liberal Arts Curriculum* (Totowa, NJ: Rowman and Allan Reid, 1985).

[3] *Teachers for the 21st Century: Report of the Task on Teacher Education* (N.p.:Missouri Opportunity 2000 Commission, 1988).

[4] *Ibid.*

The Structure of the University and Goals and Values

Charles E. Odegaard

I find it difficult to chart a course for the "university of the future" as to its impact on the goals and values of the educated citizen without first making an effort to look at the ways in which our past still conditions our lives in the present university. In the light of this consideration we may then reach some conclusions as to ways in which we would wish to change the present university to conform to our vision of a better university for the future.

The circumstances of my life have worked to induce me to think much about universities. As a historian of medieval Europe I had reason to study the long and arduous struggle to revive and expand learning in monastic and cathedral schools and in the newly invented universities of the higher middle ages. I have followed the story of the great expansion of universities in the modern era. As a professor of history, as a dean of arts and sciences, and as a president of a university, I have had few opportunities to escape from life within a university. I have not sought an escape. I have enjoyed my life in universities. I regard them as one of humankind's better inventions.

Useful and good as they are, I have come to believe progressively in my lifetime that there are also pervasive weaknesses in the modern university in the degree to which the goals and values of the educated citizens are addressed. To put the matter more specifically, goals and values of human beings are all too often not addressed on wide reaches of a university campus even when values are clearly implicit in matters under discussion and when choices for action are imminent. In our universities the hand of history lies heavily on the present, the relevance of some of which to our present circumstances can surely be questioned now.

Let me explain. In the sixteenth century Europeans were afflicted with bloody, religious conflicts over the fate of the human soul under God's rule even as they were actively engaged in voyages of discoveries and inventions of things on this earth. These disparate interests were made tolerable, particularly in the Anglo-American part of the world, by Francis Bacon, whose doctrine separated the human being into a soul with relation to God and the hereafter, the domain for theology, and a body embedded in relationships with this world. It was to the acquisition of greater knowledge about this latter aspect that he particularly devoted attention. In a succession of tracts he urged a preoccupation with the study of this world of the here and now, through the careful use of the senses of the human body and instruments of observation. The founding by Bacon's followers of the Royal Society in London in 1662 provided a focus for later Baconians to pursue interests in the works of nature, knowledge of which came to be called in English, science.

The dominant earlier focus on human beings and thier history which was also intertwined with notions about God's interventions in the life of human beings, as established in the middle ages, remained preeminently the preoccupation of the old English universities, and it was carried across the sea to the colonial colleges and their successors in the United States in the first half of the nineteenth century. In England and in the United States those interested in the study of humankind could have professional status as college professors, but there were few opportunities before the Civil War for students of nature to achieve professional status. The very names of the British Association for the Advancement of Science founded in 1831, and of the American Association for the Advancement of Science founded in 1848, speak to the sense of inferiority of status of scientific inquiry about nature in this world at the time of those who founded these organizations.

It is significant to note that the time of the founding of the British Association in 1831 there was not even in existence a word to connote a professional paid worker whose task it was to advance knowledge of science. There were men of science whose landed or bourgeois status permitted them to have leisure in which they could indulge in observation, experimentation, and discussion of nature and its workings. But there were few who could earn a living by engaging in such activities. Indeed, the word "scientist" was first proposed in a jocular fashion in a book review by William Whewell, who became an active participant in the early years of the British Association. The president of the BAAS at its first meeting spoke of giving a stronger impulse and more systematic direction to scientific inquiry, of obtaining greater national attention to science and of removing disadvantages which impeded its progress. An important objective was the achievement of professional, of working status, for men interested in science.

We are all familiar with our use of the world "science" in English typically as being rational knowledge about nature. Knowledge of the human body would be included within science, but extension of science to include knowledge about social aspects of human beings is certainly debated, and the humanistic and individual aspects are not included. In French usage, however, *science* is clearly applicable to rational knowledge of the human being as well as of nature. The same is true for *Wissenschaft* in German.

At the same time that British and Americans were organizing themselves for more support of science, for more intensive study of nature, there were developments in German universities affecting professional roles which were to have a profound effect on British and American universities in the later nineteenth century and the twentieth century.

Let us first note the basic characteristics of scientific thinking by quoting from a recent article by Schwartz and Wiggins:

> Science differs from ordinary life. This difference lies primarily in the determination of scientists to base all their beliefs and practices strictly on evidence. Science, in other words, subjects its beliefs, attitudes, and activities to the following methodological principle: nothing shall be accepted as scientific without being confronted with all possible evidence regarding its truth or falsity. Scientific beliefs about a topic must be based on some directly given features of that topic. Evidence is direct givenness. Science, then, can study only those topics that, in some manner, can directly present certain aspects of themselves to the researcher. What counts as evidence depends on the subject matter under study and the perspectives through which we can gain access to it. Different sciences must accordingly adopt different modes of approach or different methods for gaining evidence of their difference subject matters. No topic can be scientifically investigated, however, unless there are ways in which some of its features can be directly given. By reference to these direct givens, scientific beliefs stand or fall.[1]

A noteworthy aspect of the German reforming movement toward scientific-type thinking within universities was that emphasis on such thinking in their universities actually began not in the study of nature but of human beings. It began with the study of evidence contained in ancient texts and artifacts about Greeks and Romans. A resounding salvo for this reform was sounded by the first professor of philology appointed to the new University of Berlin in 1806, when he founded in 1807 a new journal about the ancient world in the prefatory article of which he stated:

> If a closer description of the whole of our science is demanded it will treat the sum total of that knowledge and information which acquaints us with the deeds and the

> fates of the Greeks and the Romans, their political, intellectual, and domestic circumstances; with their languages, arts, sciences, morals, religions, national characters, and patterns of thought. . . .[2]

Slightly later what has been called the research imperative was applied to the study of the natural sciences. This reform was accompanied by increasing specialization of subject matter in an increasing number of fields of inquiry; by the founding of specialized libraries and laboratories; by the formation of specialist societies to arrange meetings of specialists and to sponsor learned or scientific journals, contributions to which are subjected to review by scientific peers; and by the founding at universities of special courses and seminars for the advanced training of students. With the impact of this research imperative on our present multi-specialized universities one is all too familiar.

With these newer nineteenth-century developments we have not escaped in America and Britain the heavy hand of our earlier inheritance from the era of Francis Bacon. In our universities we are still saddled with a traditional split in orientation and attitude. A quarter century ago it was described by C. P. Snow in the following words:

> In our society (that is, advanced western society) we have lost even the pretence of a common culture. Persons educated with the greatest intensity we know can no longer communicate with each other on the plane of their major intellectual concern. This is serious for our creative, intellectual and, above all, our normal life. It is leading us to interpret the past wrongly, to misjudge the present, and to deny our hopes of the future. It is making it difficult or impossible for us to take good action.[3]

He identified one group as that of the scientists, adding, "whose weight, achievement and influence did not need stressing." What had been among protagonists of science 150 years ago a feeling of inferiority in status by now has surely become a position of greater and assured status, on the part of some scientists perhaps even a feeling of superiority. The others, the members of the second culture whom Snow called the literary intellectuals and whom we would more likely call the humanists, through the operation of the free elective system in the universities, have certainly lost their earlier dominance over the university curriculum. During my entire experience in the American university world, the humanities in particular have been undervalued and underused in university curricula. It was the desire to try to influence this cultural imbalance which over the years largely pushed me in the direction of academic administration.

The educated citizen who emerges from a university of the present, and certainly of the future, should have some perspective on the world around us, on the world of nature and human beings, and on the human being's responsibility toward the natural environment and participation as a responsible individual in the surrounding social networks. Such a perspective should therefore include an awareness of self and the values which influence one's own conduct as well as knowledge about others with whom one shares participation in this life. Admittedly, this will require a lifetime of effort, but the university should provide learning experiences which help the student get started on these varied tasks. The split of the university into two cultures, each uncomprehending of, and unsympathetic to, the other, is a strong deterrent to the student's acquisition of such a base for a lifetime of learning.

As a protagonist in particular of the humanistic culture, let me point to hazards within this group. For very good reasons humanists have a strong historical approach to humans and their works. *Homo sapiens* is a member of a species particularly dependent on the prior members of the species, dependent for nurturing during a long youth and adolescence, dependent as a socialized animal on spoken languages by which memories of older generations are passed on to younger members, and even on human writings and artifacts which amplify the sources of information as to prior experience of the race. Indeed, every individual human being has a personal history by which to identify his or her own self. It is this story which gives selfhood, identity.

Those who study historical phenomena in various disciplines can and should make every effort to make objective use of evidence about episodes in the past, to approach their investigation scientifically, to acquire as accurate as possible an understanding of humankind's past. Writing epitaphs for the dead, however, should not be the only objective. There are also other uses for the study of humankind's past. One can also ask to what extent humankind's present, any human's present, is still influenced by the past through unconsciously preserved traditions, responses or actions the relevance of which to current circumstances can also be questioned and evaluated.

By way of a quick example let me cite my experience as a young instructor in history at the University of Illinois in the late 1930s when, fresh from a year in Europe and from graduate school at Harvard, I first offered my course in medieval intellectual and religious history. I began at the beginning, so to speak, with the circumstances at the collapse of the Roman Empire in the west and then presented materials in lectures and readings on succeeding centuries of the Middle Ages. Few of my students had seen any relics of medieval civilization. I soon found it heavy going, the students seeing little relevance to them in the matters presented. I learned the hard way that teaching involves teaching something to somebody and that I had to address the student as well as the subject. The next time, in recognition of the fact that my students had been exposed in various ways to Catholic, Protestant, and Jewish cultural traditions, I began with a couple of discussion sessions devoted to eliciting conversations about their own beliefs and values. Then ensuing discussions aroused a heightened awareness of their own beliefs, and of similarities and dissimilarities among them. This discussion triggered curiosity about the origins of their beliefs and led to a more critical analysis of their own values. It also made the experience of their medieval ancestors seem less remote and more relevant to an enlarged perspective on the human condition, including their own.

The deleterious consequences of what Snow called the split of intellectuals into two cultures appear in many areas of modern universities. An obvious example is in the education of physicians. When universities began to undertake responsibilities for medical education in the United States barely a century ago, the Flexnerian program established then and still dominant now, focused narrowly on a biological base for medicine, on diseases of the human body. The medical student's study of the human being has been confined so to speak to what lies beneath the skin. The educated physician's disinterest in what lies outside the skin, on the human being as a whole, as a social animal, was satirically expressed by a critical physician in a recent article entitled "I Can't Hear You While I Am Listening" (obviously with a stethoscope to sounds inside the chest and belly, and not to words emanating from the patient's mouth). In the last 20 years there has developed a heretical movement, not to detract from the bioscience model, but to implant it into an interactive biopsychosocial model in which the patient is perceived as a body within a particular person within a specific social and cultural system. It must be admitted that exponents of this heretical doctrine still face a difficult struggle to convince the dominant purely scientific majority in medical schools of the need for change in the content of medical education. In recent years developments in diagnostic and therapeutic technology in medical practice have also produced a mounting interest in and concern about ethical values.

Business management, like medicine, has been under pressure to add to systems of management and analyses of bottom lines a new and intensified interest in people as keys to success. Thomas J. Peters and Robert H. Waterman, Jr. have described lessons from America's best-run companies in their best-selling book *In Search of Excellence*.[4] They focus on learning the customer's preferences and staying close to him, and on productivity through people by creating in all employees the awareness that their best efforts are essential and that they will share in the rewards of the company's success. Peters in a recent newspaper article speaks to the disturbing challenge to

American industry so evident now, and affirms that "Humanism is industry's last chance for survival." Competitive survival requires organizations to focus on people on the production line and in the field-service force. I recently read an Associated Press dispatch about how business schools are intensifying efforts to instill ethics in students who will enter a world scarred by scandals. It noted that the Harvard Business School had just announced that it was receiving a $30 million gift to finance a program on ethics teaching with most of the money coming from John S.R. Shad, outgoing chairman of the Securities and Exchange Commission. The latter was quoted as saying, "I've been very disturbed most recently with the large numbers of graduates of leading business and law schools who have become convicted felons."

Engineering schools, of course, are heavily involved in educating students in the technologies related to the building of our material environment, as are schools of architecture and urban planning. Edward Wenk, Jr., an engineer who in 1959 was the first science and technology adviser to Congress and later served on the science policy staff of Presidents Kennedy, Johnson, and Nixon, ultimately became a professor of engineering and the social management of technology at the University of Washington. Now emeritus, he has recently published *Tradeoffs: Imperatives of Choice in a High-Tech World*.[5] Technologies have functioned as a source of many treasured freedoms and, he notes that for a century we have glorified technology to the point of being hooked on it. We are only now becoming aware of more potent and dangerous side effects, as at Chernobyl. Concern for various forms of environmental pollution is growing on every hand. Wenk has argued the case for preparing engineers in the humanities and social sciences to alert them to the social consequences of technology. But he points out that the loops of individuals and organizations responsible for making decisions about technology may be vastly different from those responsible for implementation. As he says, "In short, we arrive at a striking conclusion: technological delivery systems are not mechanisms. They are organisms."[6] They are people who need to be guided by awareness of human values at stake in decisions as to mechanisms. Faculties for the professions responsible immediately for technological changes in our material environment should add to the curriculum a consideration of the human and social consequences of proposed changes, and they have an opportunity to contribute to the education of students taught by other faculties to become responsible social decision-makers.

General Motors seems now to be listening to these critics of neglect in the humanistic education of businessmen and engineers. It provided *Time* magazine of April 27, 1987, with a full-page advertisement, as it says, "as part of our continuing effort to give customers useful information about their cars and trucks and the company that builds them." They care also about their employees, for the ad is headlined "How to Run a Factory Without Any

Neckties: Let the People Participate in Managing the Business." It reports that "when General Motors worked out its strategy for the Eighties, it was clear that the development of a new method of production would have to proceed along two lines: technology and people." Its goal was "to integrate new technology with new social systems in a human partnership that gives people authority over machines and responsibility for their work." It asks "Did the Japanese or the Europeans have the answer in their management systems?" (Do you suppose Halberstam's *The Reckoning* became required reading in the GM Board Room?) In any case, changes are underway. The ad reports that "at one time, in every GM plant, the managers wore neckties." Not at Fort Wayne [the new GM assembly plant for full-size pickup trucks]. "The necktie, long the symbol of the distinction between white-collar and blue-collar workers, has been banished." The GM ad continues appropriately: "Symbols aren't everything, of course, but the symbols of confrontation have been replaced by the symbols of cooperation. Everybody eats together, parks together, and works together." The ad continues with references to growing areas of cooperation within the plant.

I do not mean to be satirical at the expense of General Motors. Industrialists, business executives, physicians in many instances surely have been subconsciously influenced also by their educational experience in universities. There is a kind of pervasive environmental pollution within our world, too, which affects others as well as us academics.

In our universities we must make renewed efforts for conversations not only between the two cultures but across the many boundaries of the specializations that exist within our universities. We may not become "Renaissance men" but we could try to become better neighbors in the university of the future, guided by a more active consideration of values more consonant with our needs than is yet provided in the divided and splintered university of the present.

It is difficult to avoid the conclusion that we have been passing through a period in American society marked by an excessive preoccupation with things and a relative neglect of people, as persons. I am heartened by evidences of a greater concern in various parts of the modern university for greater consideration of human goals and values and of the whole of humankind as a part of nature. I am hopeful that the "university of the future" will achieve a more balanced study of humankind and nature and communicate it to its educational offspring.

Notes

[1] Michael Alan Schwartz and Osborne Wiggins, *Perspectives in Biology and Medicine*, 28 (3):1985, 345.

[2] R.S. Turner, *The Prussian Universities and the Research Imperatives, 1806 to 1848* (Ann Arbor, Michigan: University Microfilms International, 1973), p. 282.

[3] C.P. Snow, *The Two Cultures: and a Second Look* (Cambridge: Cambridge University Press, 1965), p. 60.

[4] Thomas J. Peters and Robert H. Waterman, Jr., *In Search of Excellence* (New York: Warner Books, 1982).

[5] Edward Wenk, Jr., *Tradeoffs: Imperatives of Choice in a High Tech World* (Baltimore, MD: Johns Hopkins University Press, 1986).

[6] *Ibid.*, p. 31.

Public Higher Education in the Twenty-First Century

Edward H. Jennings

As higher education seeks to respond to the challenges of the future, I believe this is a time in which opportunities for progress, for creativity, for innovation, and for growth abound. This is a time in which changing needs and expectations in society are calling forth corresponding changes in our academic communities. We are now setting the stage for the twenty-first century--a century that will see great and fundamental changes in all of higher education throughout the United States, in institutions large and small, public and private. Of course, all colleges and universities look to the future, because they provide the educated human resources that will shape our nation and the world. But it is my premise that the university of the future is the public university. The twenty-first century will be the century of public higher education.

Within the next two decades, public universities will assume center stage as this nation's and, indeed, the world's preeminent institutions of higher education. The signs are so clear that the question to be answered in the coming years is not whether public universities will dominate, but which ones will emerge at the forefront. America's public universities have been pursuing a strategy that ideally prepares them for the changing demands being placed by society upon all institutions of higher education. There are four clear reasons why the public universities will lead higher education into the twenty-first century: our size, our support for interdisciplinary endeavor, our diversity, and our accessibility.

The historic commitment of our public universities to broad access, which has led to expansion in numbers of students and diversity of programs, has resulted in considerable size and scope. That allows our major public universities to benefit from economies of scale. And in today's society, such economies bestow greater advantages than ever before on institutions of higher education that happen to be large. Consider the start-up costs involved when a new chemist, for example, begins work at a university. The cost of salary, a laboratory, the research assistants, and so on, may total as much as several million dollars--a substantial investment which may be well beyond the means of smaller institutions. And while it may seem that supporting a scholar in the traditional disciplines of the humanities, for example, would be less expensive, that is only true if you do not count the cost of the extensive libraries required to inform his or her work. A large university is best suited to sustain comprehensive libraries that contain millions of volumes; or to create facilities which set new standards for architecture, at the same time that they house interdisciplinary programs on the cutting edge of scholarship; or to conduct all of the massive scientific projects that demand the superlative prefix: supercomputing, super-telescopes, superconducting supercolliders.

The image of the scholar sitting alone in a laboratory or library writing for publication no longer fits academic research. Research is teamwork now. And comprehensive public universities are well positioned to respond to the nature of scholarly activity, which is changing rapidly and radically. New discoveries come from scholars in many disciplines working together. Where else but in a comprehensive university can society expect progress in biotechnology, which must draw together individuals with expertise in the biological sciences, business, chemistry, medicine, mathematics, and agriculture--and which poses some questions best addressed by those in ethics, sociology, and political science? Where else can society realistically place its hopes for cures for all forms of cancer, when the research may involve disciplines as far-ranging as veterinary medicine, social work, engineering, computer science, and all of the varied health care fields? Where else can society seek deeper understanding among the diverse peoples of our planet, when such knowledge depends upon the shared research and scholarship of historians, philosophers, language professors, geographers, artists, economists, and poets?

The comprehensive public university is best suited to create, to nurture, and to sustain those who thrive on the fundamental ingredient of a great modern university--the size and accessibility that, while no guarantee of diversity, can generate diversity. Diversity that encourages debating new ideas by new generations of students; that engenders interactions among individuals of differing cultural heritages, through a strong commitment to affirmative action; that creates and energizes the best possible academic environment. This diversity also provides a key aspect of the curriculum for our students, part of whose education must be the breaking down of barriers of racism and ethnocentrism. These are difficult lessons, but invaluable ones, as new generations face a global future.

At some of our public institutions--such as Ohio State, with its nearly 60,000 students--size alone fosters diversity. But the public university tradition has actively developed it. Through history, we have established the foundation for a future in which the public university will be the most vital and important provider of an educated citizenry. The American university imported from Europe the concept of the graduate institution, and blended it with our populist ideals in founding the land-grant universities. Two hundred years ago, the first region of America outside the original 13 colonies was developed through the enactment of the Northwest Ordinance, when the nation's "northwest" region extended to what is now the states of Ohio, Indiana, Illinois, Michigan, Wisconsin, and part of Minnesota. One of the most far-reaching ideals fostered by the Ordinance, and by the Morrill Act of 1862, was popular access to higher education through institutions supported by the sale of public lands. The Hatch Act of 1867, which established agricultural experiment stations, represented a national commitment to the value of university-based public service.

The public institutions thus established subsequently developed into true universities, in which professional schools grew up in close coexistence with core programs in the arts and sciences. The land-grant institutions were specially charged with the creation of an educated citizenry by providing accessibility to all qualified citizens, regardless of their social or economic background. This combined with the land-grant mission to achieve the ideal of public service related to teaching and research. The comprehensive American public university was born.

And it grew up, and it kept growing. Today, 78 percent of this nation's college students attend public institutions. Our land-grant universities alone, leaving aside all the other find public universities in the nation, grant 60 percent of all doctorates and number among their alumni a multitude of distinguished scholars, as well as approximately half of our members of Congress, our governors, and the leaders of Fortune 500 corporations. It is, I contend, public universities that are, and have been doing, the educational job for this country and that will continue to do so to an even greater degree in the future.

To provide an educated citizenry, we must compete for the students who can benefit most from excellence in higher education. Outstanding high school students already have many reasons to choose public universities. A growing reputation for academic quality is foremost among those reasons. But students also know that an excellent education is not only attainable, it is considerably more affordable at a public school. And this is likely to be more and more the case in the future. A student attending a major private institution can expect to pay about $20,000 a year, compared with about $6,000 a year at Ohio State, and even less at other public universities.

From 1978 to 1987, private university tuition, adjusted for inflation, has increased 24 percent. For the same period, inflation-adjusted tuition at Ohio State went *down* one percent. Even with financial aid, the cost of attending college can be daunting to students, who must anticipate shouldering a heavy load of debt as they graduate. The educated citizen of the future is more and more likely to be a public university graduate.

Our alumni are a varied group, with degrees, interests, and careers as diverse as their alma maters. The public university has always been a conglomerate--an amalgam--that finds nothing odd in bringing together as colleagues a professor who studies classical Greek art, and one who illuminates principles that enable us to build machines to walk on Mars. It has no trouble including the research scientist in the laboratory, addressing the finer points of genetic engineering; and the professor of animal science or entomology who may be found walking the fields with the owner of a family farm. It is through this collegial practice and attitude, and through an historic commitment to accessibility, that the major public university extends to students the ability to gain diverse intellectual rewards. We are not only preparing our graduates for their first job, but for their careers, which will span the turn of the twenty-first century; not only instructing them in specific courses, but instilling in them the value of life-long learning.

With a core undergraduate curriculum based firmly in the liberal arts, and with extensive resources, the comprehensive public university can give its students the chance to become broadly educated women and men. We must continue to make ample room for the differences of thought that will be the hallmark of our future society, and to provide access to the best of higher education for all qualified persons. We must use our size and scope wisely, ensuring that individuals are not lost in the system, but are nourished by its richness. We must maintain a firm commitment to the quality of our curriculum and seek to establish the very best in undergraduate and graduate teaching, if we are to produce the educated citizens our society increasingly will require.

In the modern world of expanding technology, changing political and cultural values, and an economy that is truly worldwide, the successful individual of the twenty-first century will be one who is flexible, innovative, creative, adaptable, and comfortable with things new and different; one who has learned how to learn, to find and use new information and, for all our sakes, to act--and act ethically--on assimilated knowledge. This is the individual manifestation of the task of the university itself--a task which our major, comprehensive, public universities are exceptionally well suited to undertake. I believe that universities such as Ohio State and others like it can aspire to be among the leaders in this endeavor. Our leading role will come from a renewed focus on qualitative growth based upon our particular advantages: size, which offers economies of scale; limitless opportunities for interdisciplinary research and teaching; rich diversity; and broad accessibility.

Many state universities are relatively young. But as comprehensive public institutions, we have a combination of resources more significant than a long history. They give us major advantages in a higher education environment that is increasingly competitive. Historically, we have not always been able to capitalize on these advantages. Like many public universities, in the post-World War II period, we had to focus virtually all of our resources primarily on the demands of enormous enrollment growth. This boom period lasted a quarter of a century, until the constraints and retrenchments of the past decade challenged us to adapt to an era of no growth. In earlier times, before the war, the Great Depression had severely limited our development. Holding the institution together through unprecedented economic upheaval was the prime consideration. Before that, it was the post-World War I growth that was the dominant demand on institutional resources. And, in the years before and just after the turn of the last century, we were truly new and struggling universities. This description fits most major public universities of the United States.

But now, with a critical mass of faculty research talent attracting outside funding with increasing success into public institutions, with enrollment stabilization easing demands for quantitative growth, with broader legislative recognition that economic recovery is linked to higher education quality; with more public university alumni seeking to give back some measure of their success in private gifts to their alma mater, we now can build upon our distinctive advantages and strengths as comprehensive public institutions of higher learning.

In this setting, interdisciplinary teams can come together from many fields to explore the future of scholarship, even as they themselves create the new knowledge that society needs.

In this setting, we are finding ways to maintain our strong commitment to accessibility, even as we uphold our academic standards through relatively new selective admissions policies.

In this setting, the diversity needed in a university community can flourish, through our commitment to affirmative action, which we seek as a moral obligation based not on legal requirements, but on our mission to respond to and serve society as a whole.

As we approach the year 2000, the nation's public universities can, for the first time, focus all our resources--human resources, financial resources, and intellectual resources--on excellence and qualitative growth, which is now the single dominant force moving us forward. Qualitative growth is the force that will lead us to pre-eminence in the twenty-first century. Higher education will continue to be the heart of modern society, and a key factor in maintaining our leading position in an increasingly international economy. We can meet society's changing needs, as we have done before, by carrying out our mission of preserving, discovering, and transmitting knowledge. This nation needs educated citizens and workers; it needs the research at which we excel.

Historically, universities have been able to respond to changing national agendas, as with the space program beginning in the late 1950s and, earlier, with a commitment to agricultural research and extension that increased America's crop yields far beyond any expectations. We cannot predict exactly what new changes and challenges are in store for us. But we can be sure that, with a dedication to excellence and the flexibility to expect and welcome change, our public universities--committed to the service of society as a whole--cannot only survive, but flourish.

All of us in higher education today face new opportunities and new challenges. If any university is to achieve the preeminence that results from excellence, it will not be due to the achievement of any single student, for the hypothesis of any one faculty member, or even the perfection of a specialized instrument hand-made by a member of our support staff. It will be, fundamentally, an attitude we choose to adopt. It will be achieved because we ask ourselves to be satisfied with nothing less.

This spirit is found throughout higher education today. It is, indeed, the central task that many public universities have set for themselves. It demands a high standard for universities which aspire to excellence, as we accelerate our capacity to focus all of our resources--human, financial, and intellectual--on qualitative growth. It is a challenge continually posed by society, and one we will readily meet as we advance the special trust of the public university mission--the mission that distinguishes our heritage and energizes our drive to preeminence in the future as the foundation of this nation's progress.

The Challenge for Public Higher Education

Myles Brand

The subject matter of this paper is actually narrower than the title suggests. Public education is a massive system in this country, from two-year institutions to comprehensive universities, from ones of a few thousand students to the enormous land-grant institutions approaching 60,000 students. My focus will be on the large, research-oriented comprehensive public universities, many of which are land-grant institutions. These universities, which trace their lineage to the 1862 Morrill Act, are arguably the heart and soul of American public higher education; for it is they who provide much of the leadership in research and instruction, who are often the port of entry for students of diverse ethnic and racial backgrounds, and who provide truly comprehensive education in diverse fields, from agriculture and engineering and other professions to the liberal arts and sciences. I will also limit the discussion to a specific time frame--the present to the end of the century.

Even with these limitations, the task is enormous. I will focus on several key challenges. These challenges are unified by two main themes. The first theme is that these large public universities must maintain a delicate balance between conflicting trends and forces. There is a fine path they must tread if they are to achieve their goals. The second theme is that these universities will have to meet their goals and achieve qualitative improvement with essentially stable resources. Public higher education is no longer a growth industry. Success depends on being able to progress in an environment that does not support expansion.

The first challenge for these institutions is to achieve true diversity. The large publics need to diversify their student bodies, their faculties, and their programs. The minority populations of this country are increasing. By some estimates, this country will be one-third minority by the turn of the century. Yet, with the exception of Asian-Americans, the percentage of students presently moving from high school to four-year institutions is significantly lower among minority than majority students. The problems are especially acute for Black students. Over the past decade, Hispanic students have increased the percentage by a small margin. But Black students during this period of time have decreased the percentage of students attending four-year institutions. This decrease has taken place despite the fact that the percentage of Black students graduating from high school has increased. Black students are entering the armed forces, two-year colleges, and entry-level positions in service industries, but not generally attending four-year institutions. There is the real threat that Blacks and Hispanics will not be appropriately represented in the managerial and professional class of the future. This is a moral problem, for it excludes populations from benefits on the basis of race and ethnicity. It is also a social problem: this country lacks the luxury of excluding large numbers of highly qualified persons from its professional, managerial, and academic positions; global economic competition simply does not permit it.

The land-grant universities are often the point of access for racial, cultural, and religious groups. It has traditionally fallen to these universities to provide access to the quality of life that an educated class can enjoy. It has been part of the mission of land-grant institutions to provide this access, and that mission remains.

Access is not sufficient, however; universities must make known the opportunities that exist and motivate students to take advantage of these opportunities. Students are ordinarily recruited in their last year or two of high school. But by the time minority students reach their junior and senior years in high school, their academic future is already charted. A college preparatory curriculum in high school is a primary determinant for entrance and success in college. Too few minority students undertake such a course of study.

One solution is early intervention. Goals must be set early and retained throughout high school. Probably no later than middle school, students must be motivated to act. Several years ago, Eugene Lang, a New York industrialist, had a brilliant idea. He was to address a grade school class in Harlem, in a school from which he had graduated. As he stood up to speak, he threw away his prepared notes and, with great insight and generosity, offered to pay the tuition of those students who attended college. As a result, a high percentage of the students undertook college preparatory work and are now college-bound. Lang's insight was to provide a means for removing the anxiety and uncertainty about higher education that faced these students. The anxiety likely stems from an economic status that makes the cost of higher education overwhelming, and the uncertainty probably is related to a family background where higher education is absent. A successful early intervention program might attempt to capitalize on Lang's insight.

At The Ohio State University, we are undertaking an experiment to replicate Lang's program on a massive scale. Four hundred sixth-grade students a year will be admitted to Ohio State. They will be assured of appropriate financial aid. For their part, these students must take a college preparatory course in high school and must maintain good academic standing. They must also participate in summer programs designed to develop study skills and introduce them to the pleasure and excitement of the arts and sciences. Students will also be provided with community mentors who will relate first-hand the advantages of a college education. This is, in short, an informal contract. Students will prepare for college, with the University's help, and the University will admit them now and guarantee appropriate financial aid. This program should assist greatly in removing anxiety and uncertainty.

The targeted students in this program are underrepresented minorities who would not normally attend a university. Some minority students do not need this program; they are sufficiently well motivated by their families and peers and sufficiently successful in school that it is obvious they will attend a university. Some others will not find college useful or attractive under any conditions. But there is a large middle group, students who otherwise would miss the opportunity to attend college, to which this program is directed.

Though this is a large-scale project for Ohio State, it nevertheless effects only a small proportion of the minority population in the State of Ohio. In order for it to have significant social consequences, a number of the universities in the state would have to act in concert. Similarly, early intervention programs will need to be implemented in every state if there are to be long-term national consequences. At this time, it remains unknown whether public--and private--universities in Ohio and elsewhere will utilize early intervention as a means for providing access to underrepresented minority students.

The challenge of diversity concerns not only American minority students but also international students. It is clear that international factors have come to affect our living conditions greatly. Communication systems have made international interaction commonplace; the stock market, to name one obvious example, is affected by worldwide conditions. Competition for products extends beyond the next state or region of the country. American industry needs to respond to growing international competitiveness. American universities, in particular, are pressed to respond. They must do so by educating students about the diverse cultures of the world, by developing programs that provide an international knowledge base.

Traditionally, international cultures have been taught through language courses. In American universities, we are seeing the return or strengthening of language requirements. Language instruction is one way to achieve a sense of other cultures; but it alone is hardly the best way. Learning vocabulary and grammar of a foreign language does not necessarily give one an insight into the way people of that culture think about the world.

Moreover, most language instruction in this country involves western European languages, and these are not helpful in gaining an understanding of the Pacific-rim countries. I would suggest that as an alternative to some language instruction, there be direct instruction in history and culture. Books read in translation can give insight into the culture of another country, perhaps more so than excerpts read, but barely understood, in the original.

This suggestion, no doubt, will not be readily accepted by my colleagues in language departments. One does not know how a Russian thinks, unless one thinks in Russian. Full understanding of a culture requires knowledge of the language. This view is controversial, but let us grant that it is correct. The problem is that universities cannot provide that depth of language instruction to the average student so that he or she reaches the level of competency necessary to think in Russian or in Japanese or Chinese. The alternatives are to restrict instruction to a rudimentary understanding of the language or to provide access to the culture through alternative means. Given the amount of time and energy that students can be expected to devote to these studies, some acquaintance of historical, literary, and philosophical texts in translation may be the preferable course. Note that I am not recommending that language instruction be eliminated from the curriculum. In addition to some cultural exposure, it provides students with some sense of the nature of language. The point is that exposure to other cultures is likely to be best achieved by means of both language and history, literary, and culture courses.

Our graduate schools in certain fields are being filled by growing numbers of international students. In business, engineering, and some of the sciences, the graduate population in the large publics exceeds 50 percent. There have been calls for increased domestic participation in our graduate schools. The reasons for the recent decline of domestic participation are varied. After graduation, American industry skims the best students with a bachelor's or master's degree; the attractiveness of these entry-level jobs entices students away from continued study toward the doctorate. Contemporary American students often do not find an academic career attractive, at least not so much as students did several decades ago. The life of intellectual pleasures afforded by the academy is no longer so attractive as making one's place in the business world.

I should like to suggest, contrary to most opinions, that the problem is not great. American universities have become magnets for the best minds in the world. Although it is true that many of the international students return to their home countries, others stay. It is difficult at this time to predict future proportions, but if only one-fifth remain in this country after receiving graduate education here, they will have significantly added to the store of persons who will contribute to the intellectual base of this country. It should also be remembered that the investment in international students is comparatively small. These students are often educated through college in their own countries, and come to the United States only for advanced graduate education. Leaving aside those who pay their way, we invest tax dollars only during this portion of their education. Essentially what has happened is that the pool of students from which American graduate schools draw has increased. The larger the pool, the better the opportunity to attract the best minds. It is mainly chauvinism that speaks against accepting into our graduate programs the best international students. Of course, this argument does not speak against trying to reverse the trend that draws domestic students away from graduate programs. Here, too, we want to enlarge the pool of potential graduate students; for it is by doing so we develop the best chance to retain worldwide intellectual and technological leadership.

The second challenge facing public higher education in this century concerns its funding base. Land-grant institutions, which often are the state flagship institutions, have been experiencing decreasing funding from the public sector. In the 1950s many institutions received a far greater proportion of their income from their states. There are many more demands on state budgets, including roads, prisons, entitlements, and the sheer growth of government. A number of states have seen a proliferation of institutions of public higher learning. These secondary and tertiary institutions deprive the flagship institutions of resources. Federal support, by the same token, is not increasing. Federal research grant dollars have remained essentially flat since the late 1960s. The pressure from federal entitlement programs, from deficit and interest costs, and from defense spending, make it highly probable in the next decade that universities will not receive an increased share of the federal dollar. All these are fiscal facts of life.

It might be thought that the large publics can accommodate this loss in revenue by locating new sources of funding. There is some possibility for philanthropic income. In the past, land-grant institutions generally received a very small portion of their income from philanthropic activities, primarily through alumni giving. Indeed, it was thought in some quarters that public universities should not seek private funds; that activity was to be left to private universities. Recently, however, public universities have become more active in development campaigns. This type of funding can indeed provide additional resources, but its extent should not be overestimated. Suppose that one were able to create an endowment of $500 million dollars, an enormous sum for a public university. At 6-percent interest income, that results in $30 million per year. The largest public universities have annual expenditure budgets of $1 billion per year. Although the additional $30 million would be of assistance, it cannot substitute for the needed operational funds. While important, especially on the margin, philanthropic income is not the answer to the problem.

Another possible source of funds is the industry and education partnership. For a time it was believed that the best means for creating these partnerships was through research parks. There have been many attempts to create incubation research parks, but few successes. The major ones include the research triangle in North Carolina and Silicon Valley in California. The country, however, is crowded with failed research parks. Few industries see it in their advantage to enter into the kind of partnership that would be attractive to universities. The university wants agreements that enhance graduate education and basic research; but industry is primarily concerned with product development, testing, and highly applied research. At present, these partnerships rarely provide to universities the additional resources for significant incremental growth. This situation will not improve until private industry takes the long view and invests heavily in basic research or until universities subordinate basic research to applied research. I do not foresee either of these alternatives' occurring in the near future.

The best prospective answer may lie in the ability of the large publics to marshal extant resources. There are two ways to achieve this end. First, they need to contain costs. They will need to operate in a leaner way. Since most university funding is used for personnel, they will have to eliminate some jobs. Approximately 80 percent of the personnel at the large publics are support staff, that is, nonfaculty positions. These staffing areas need to be examined carefully, since the majority of cutbacks will have to occur in this sector of the workforce. The second means is to direct funds to academic programs that are growing in strength or present significant opportunities and away from programs that are unproductive and weak. These are hard decisions for a bureaucracy to make, but necessary ones. There does not appear to be any other source of funding for qualitative growth on the horizon. In short, the large publics will need to develop qualitatively through better management of their present levels of funding.

The third challenge facing the large public universities is capital improvement. It is not an exaggeration to say that for large publics, space is the most pressing problem. In many instances there are aging facilities. Instructional and research space receives hard use. Classrooms are occupied often eight or more hours a day and laboratories even more than that. Changing technologies cause space problems. For example, an English composition class that might be occupied by 40 students using traditional blackboard methods can only accommodate 20 students using computer and word-processing equipment. New technologies take more space, not less. The problem is especially acute in research. Start-up costs for scientific activities often include major space renovations and additions. Grant funding ordinarily does not provide resources for renovations and major space additions. Federal grant indirect cost recovery keeps the lights on, but is not adequate to finance new space. Occasionally a federal agency such as the

National Science Foundation will provide funds for new buildings; but, to date, these funds have been far too small to make any substantial difference.

There is a special problem for libraries. Libraries are undergoing technological change. In the near future, access to information through online devices will require more space on campus. Some access will be available from student dormitories and faculty members' offices; other access will have to be provided in the library itself. The medium of books will not disappear before the end of the century. Libraries, then, will have to provide for both book storage and computer access.

The last two challenges involve issues of resource management. Because of reasonably strong state and federal support in the past, the large publics have not had to face this issue forthrightly. They will have to do so in the next decade. One potential means to deal with resource management is to become more specialized--*but* to do so while retaining a commitment to diversity.

Specialization is not uncommon for private institutions. Massachusetts Institute of Technology, Carnegie-Mellon University, California Institute of Technology, and a host of others specialize in science and engineering. And within these general fields, there is sometimes additional specialization undertaken. Carnegie-Mellon, for example, has focused much of its activity on the information sciences. The large publics, however, have not followed this line of development. Rather, they have attempted to provide coverage in all fields. There are certain advantages to this approach. It enables these universities to undertake multidisciplinary work that is difficult in other settings. For example, biotechnology is best undertaken in an environment that includes a medical school, agriculture, pharmacy, biological sciences, and so on. This broad band of disciplines is not likely to be found other than at the large publics. Nevertheless, this approach has its costs. By attempting to do everything well, a university can quickly outrun its resource base. The large publics will have to create a delicate balance between specialization and program diversity. They will need to continue to serve diverse constituencies in agriculture, medicine, engineering, and so on, while at the same time narrowing their focus so they do not overly disperse their resources.

Consider agriculture, a field common to land-grant institutions. While these institutions need to continue instruction and research in agriculture, they will have to pick and choose their targets within the field. It is not true that everything about agriculture should be given equal credence and resources. Choices will have to be made on the strength of the existing programs and faculty, on the perceived needs of the constituencies the university serves, and on the projected future of the field. Each university will have to find for itself a series of niches in which to fit. While there are many colleges of agriculture, not all should be working on the same set of research problems. Some colleges might focus on biotechnology, others on post-harvest production, and others on traditional land use. The delicate balance is to be struck in this way, then: program diversity is to be met in that all traditional areas will continue to be served; but specialization is to be observed in that universities will have to choose areas of concentration *within* these traditional areas.

Another resource-related challenge concerns faculty recruitment. Some projections have it that close to one-half of the nation's faculty will be retiring by the end of the century. The demographic profile of the faculty make this result apparent: most faculty now in our large public institutions were hired in the 1960s. It was during this period that the large publics responded to growth pressures, for it was then that both the baby boom population was coming through the school system and the percentage of the general population seeking college education was increasing. The problem is somewhat exacerbated by the fact that university teachers tend as a group to retire somewhat earlier than the general population. State and institution early-retirement incentive programs also reinforce this trend.

On the surface, there should be an advantage to an institution to have faculty retirements. Relatively high-paid senior faculty retire and are replaced by relatively low-paid junior faculty. While there is some advantage to this shift, it can be outweighed by the cost of recruitment, retention, and start-up.

Junior faculty are coming to be in demand, and this demand will increase in the future decade. The problem is most severe in a number of scientific, technical, and applied areas. Computer science, accounting, finance, electrical engineering, to name only a few, are finding it increasingly difficult to recruit junior faculty. The competition for these faculty has increased to the point that starting salaries approach those of the retiring faculty. Salary compression--the collapsing of the pay range for the majority of faculty--has seriously eroded the funding differential between junior and retiring faculty. But that is not the heart of the problem. Start-up costs for new faculty override potential savings, at least for the short- and middle-runs. Space renovation, laboratory equipment, and support staff can easily amount to $250,000 in science or engineering departments. That is the amount for junior faculty; it can easily double or quadruple for senior faculty. Start-up costs are not restricted to faculty in science and engineering, moreover. In the case of business, and even humanities, it is often necessary to provide summer salary for a period of time, computer equipment, and other support for the best faculty. The pool of highly qualified faculty has diminished to the point that such "packages" are often necessary.

Another factor that reduces the advantage of replacing senior faculty with junior faculty is that, in a number of cases, newly hired faculty have reduced teaching loads. Faculty hired during the expansionist years of the 1960s were brought into institutions with the expectation that they would focus on instruction, but since that time, institutional priorities have changed and there is more of an emphasis on research. Junior faculty hired with the expectation that they will be productive scholars and command lower teaching loads than faculty who are fully devoted to instruction. In those cases, additional faculty will be required to serve the same number of students. Furthermore, an institution would be in error to focus its hiring too sharply on the junior ranks. A good number of senior faculty must also fill the depleted ranks. And here again the savings that accrues from retirement is diminished.

In the short run, the large publics should aggressively recruit new faculty and, in some cases, "stockpile" junior faculty in anticipation of retirements. There are added start-up costs to this mode of operation; but given the difficulty of future recruiting, it is probably wise to have an oversupply now, rather than be shorthanded later. Another strategy is to pay attention to academic couples. Often the major impediment for senior faculty to transfer from one institution to another is suitable employment for a spouse. When that spouse is himself or herself an academic, an effort should be made to determine whether there is an appropriate fit with some department. Central administration will need to play a role, sometimes providing fiscal incentives to the secondary department. The usual way of doing business, in which spouses are left to seek employment on their own, has clearly been an inhibiting factor in recruitment. A fortuitous consequence of an active spousal advocacy program is that, not only can the primary spouse be successfully recruited, but the "secondary" spouse often makes an excellent addition.

The long-term solution to this problem is obvious. Students with true academic potential need to be encouraged to pursue careers in the academy. The pipeline must be filled. Personal intervention by current faculty--the role models--is critical. Honors seminars, summer research opportunities for undergraduates, and simple personal, congenial contact can be effective. In addition, of course, there must be programmatic efforts. Fellowship monies are a powerful incentive. Some of these funds can be garnered from extant university budgets, but not a great deal. Federal agencies and private industry must make investments. During the Sputnik era, federal agencies supported graduate education. However, it has become increasingly difficult to write such support into federal grants and there are few generally available fellowship programs. If we are to have an adequate supply of engineers, scientists, and business people to staff our classes and conduct research, the federal government and private industry will have to take the long view. Private industry itself will likely require incentives to undertake fellowship programs, in the form of tax relief or special reciprocal relationships with universities.

The next challenge concerns the full integration of research with instruction. The source of the problem is, in part, a reflection of the sociology of university research. During this century various disciplines have become highly professionalized. Graduate school has become not merely a learning experience, but also a socialization experience; students are made to feel part of a discipline and a universal research effort. As a result, when these students leave a graduate program and enter the teaching profession, they often continue their allegiance to the discipline and do not transfer it to the university. Few assistant professors identify with the institution in which they become employed; their identification, rather, continues to be with their discipline, defined nationally, indeed internationally. Universities, unfortunately, reinforce this attitude in their young faculty by overconcentrating on the rewards for research. In an attempt to foster research activity, it is easy for a university, through subtle and sometimes not-so-subtle clues, to give the message that research predominates. Consequently, junior faculty tend to separate research from instruction and pay little attention to the latter.

The delicate balance required is to foster respect for both research and teaching. In particular, the university must reassert the importance of undergraduate teaching. It must do this, in part, by gaining the loyalty of the faculty to the institution. The extent of identification with the institution itself is correlated to the extent to which undergraduate instruction is taken seriously; or put otherwise, the extent to which faculty see themselves as part of a disciplinary cadre of researchers is correlated to the extent to which they will tend to ignore the importance of undergraduate teaching.

There is something old-fashioned in this way of looking at things. Good faculty are highly mobile; they are in demand at many institutions. Yet institutional loyalty can be fostered by making faculty feel ownership of the institution. Natural ways to accomplish this goal include participation in the governance and decision making processes of the institution. Faculty must feel that it is their university. Leadership, especially at the presidential level, is necessary for accomplishing this transition among faculty.

A related challenge is providing excellent undergraduate instruction in an environment that is only partially dedicated to such instruction. The foundation for undergraduate education is general education. Fortunately some progress has been made over the last several years in improving general education.

The curriculum developed in the late 1960s and early 1970s in American universities has not resulted in strong general education programs. These general education curricula follow a consumer-driven model: students pick from a great variety of courses, a type of shopping around; departments put courses on the shelves to attract students, and thereby increase their enrollment and justify their budgets. Survey research at Ohio State has shown that the primary criterion for course selection for most students was the time of day at which the course was offered. That is not the best way to fashion a general education.

I recommend in place of this model a goal-directed approach. The institution needs to become clear about what should be the attributes of a well educated student exiting from their programs. Then, it must design the general education curriculum to meet this goal. It has become clear that a strong emphasis on basic skills and competencies is necessary. Writing, quantitative skills, and the ability to think critically are key components in general education. General education, moreover, is a four-year process, and does not consist in merely the introduction of basic skills. Students need to be well versed in the history and culture of America's pluralistic society; they must have a genuine understanding of technology and science; they need to have a sense of the subject matter and methodologies of the social sciences; and they must have real acquaintance with the humanities and the arts. Much has been written about general education over the last several years, and I need not replicate it here.

I would emphasize several factors, however. Much of the recent discussion on general education has focused on core knowledge. Western civilization courses as developed at Columbia University and the University of Chicago, to name two examples, have become paradigms. There is some initial plausibility in promoting core learning. Who can say that a person has been educated if he has not read Plato and Homer, Shakespeare and Dante? But there is the danger of overemphasis on a traditional canon. An appreciation of cultural and ethnic diversity and the contribution of women is made difficult by restricting study to the traditional canon. Further, knowledge of contemporary science and technology must also be part of the learning experience. Students should be enabled to understand debates about acid rain, genetic engineering, ozone leakage, lasers, superconductivity, and many other technological and scientific developments that will affect their lives.

Another factor concerns the integration of general education with major programs. Education should not be two-layered, but rather an integrated whole. Writing should be across the curriculum; it should include experiences that are typical of a student's major area, and not merely exercises in introductory composition classes. Engineers should be writing technical reports; and artists, critical accounts of historical or contemporary works. Another means of integration is a capstone seminar for undergraduates. Students should be able to see the import of their major beyond its disciplinary boundaries; for example, an engineering student might take a seminar in which the political, economic, and societal consequences of advanced technology are considered, or an art student might discuss in a seminar setting the difficulties of there being "two cultures."

There is a danger on the horizon. Federal and state legislators have begun to seek means to measure progress of undergraduate students. In particular, value-added testing has attracted a great deal of attention. The state of New Jersey plans to use this approach, for example. On the surface, this approach appears attractive: measure the students' knowledge when they enter the institution and measure it again when they leave, with the difference representing the value that university education has added. But easier said than done. If university-wide tests are given, there will be teaching to the test. This result would be hastened when value-added measures affect budgetary allocations. But teaching to a test, or even a battery of tests, is counter to the goal of providing strong general education experiences.

General education should equip students to learn throughout their lives. Universities should not be preparing students for entry-level jobs, but rather for careers. One estimate is that present-day students will change jobs 14 to 16 times and careers 2 to 4 times. They need to learn to learn. This is a higher-order skill that is not easily measured. Students must gain the ability to find out what it is that they do not know and then exercise a learned capacity for gaining this knowledge. Critical and analytic skills are crucial; factual and specific knowledge is important; but in the end, it is their ability to gain new knowledge and new problem-solving techniques that is crucial. And that ability cannot be measured by value-added testing.

No doubt, universities should be accountable for their activity. But surely accountability can be achieved in ways other than value-added testing or similar means. A well functioning program review procedure is probably the best way to achieve this desired goal. Judgments of success and failure can be made by means of self-study and especially national peer evaluation. Curriculum can be evaluated and research productivity and direction assessed. National norms, established discipline by discipline, are often the best measures. By focusing on an output measure such as value-added testing, the process loses a great deal of information.

Another challenge facing large public institutions is connectivity with two-year colleges. There is a dilemma here. On the one hand, large publics want to articulate with the two-year colleges so that students can move from two-year institutions to four-year ones without a great deal of curricula mismatching. On the other hand, the large publics want to attract students directly into their four-year programs. The fear is that students at two-year institutions will not receive adequate preparation in general education and introductory major courses. Even if the courses are numbered the same, the texts the same, and the syllabi the same, there remains the danger that instruction will not be the same. It is not a matter of whether the instructor is competent or not. Rather, the issue is whether the level at which classes are conducted at the two-year institution will be approximately equivalent to those at the large public institution. Students from two-year institutions do not face the competition in classes that four-year institutions generate. This competition affects the depth of instruction.

One possible solution to this dilemma is to limit two-year colleges to technical training and remediation. In recent years, the lines have become blurred between two- and four-year institutions. Two-year institutions aspire to become mini-universities. But there is a need for technical and vocational training and a number of two-year institutions are well equipped to provide that instruction. They are also well equipped to provide students with remediation in key areas such as math and English. On this proposal they would not undertake the kind of instruction that is now part of the curriculum of the large publics. Of course, this proposal would be disputed by two-year colleges--and with some justification. Generally speaking, the graduation rate of persons who enter universities with two-year college general education experience closely resembles the rate of those who attend four-year universities from the outset. The dilemma remains, then. Indeed, I expect this issue to emerge as one of the most trying ones facing the large publics in the decade ahead.

These challenges and others that might be mentioned present two themes. The large public universities must strike a delicate balance in the years ahead. They must develop programs that provide access for underrepresented minority populations. They must balance research and instruction, encourage faculty to participate in national disciplinary work while developing institutional loyalty, promote the importance of research without losing sight of undergraduate instruction, and advocate general education while retaining the importance of the major. The large publics must articulate with two-year institutions while arguing that students are best served by attending all four years at the same institutions.

The large publics must achieve these balances at the time that resources are becoming scarce. State and federal funding is diminishing. Private and foundation gifts and industry partnerships will not fill the lacunae. Institutions will have to progress on the basis of their ability to utilize the resources already under their control. They will have to become more efficient and more cost-effective. They will have to downsize or eliminate unproductive activities so that they can strengthen key areas and take advantage of new opportunities. They need to find sources of funding for new space and renovation. Those sources will often be bonds. The payback for these bonds will place still greater strains on the annual budgets.

Clearly some of the large public universities will meet these challenges better than others. Those that are most apt at creating the delicate balances and at self-financing their activities will emerge as the leaders of the future. There is a sorting of the large public now taking place. It may or may not be the case that those large public universities that are currently predominant will remain so at the turn of the century.

Education in the Public Research University

Kenneth H. Keller

Discussions about the future of higher education in the United States have taken on the dimensions of a national debate. With each passing month, more voices are heard analyzing and criticizing the present state of affairs--projecting, designing, or recommending some future course. We are subjected to all sorts of commentaries about the nature of the curriculum, the erosion of standards, the devaluation of teaching, the escalation of costs, the role of intercollegiate athletics, and the obligation (or danger) of involving institutions of higher education in technology transfer, in economic development, in community organization, in job retraining, or in child care. And a host of other issues have been raised by people who view colleges and universities merely as businesses to be operated, regulated, or taxed as commercial service organizations.

It is easy enough to understand this heightened level of interest. Exposure to post-secondary education--once the privilege of the few and the need of still fewer--is fast becoming the norm in our society. In Minnesota, high school graduation rates exceed 90 percent, and more than 70 percent of these graduates will become involved with some form of higher education. A baccalaureate degree is a more common terminal point for young adults today than a high school diploma was half a century ago. Colleges and universities cost society dearly; they also affect the lives of countless people, influencing health, economic development, and agriculture. Therefore, they are among the most visible institutions in our society. They are also, clearly, among the most important. The range of issues and questions raised about them reflects this importance because it suggests the many and varied ways in which universities touch people.

While the debate is salutary, it is also difficult. As one reads and listens to the various points of view, one is led to two related conclusions. First, there are great differences in the views that people hold about what the primary purposes of our institutions of higher education should be; second, those expressing these views are frequently talking about very different institutions.

At an earlier time, when higher education was a less integral part of society, differences among institutions were far fewer. While there has been an evolution from the curricular rigidity of the *trivium* and *quadrivium*, change was extremely slow until the early part of the nineteenth century. Then, new notions based upon English and German university models began gradually to be assimilated into the American system, which was also affected in various ways by the ideas of men like Thomas Jefferson, Ezra Cornell, Daniel Coit Gilman, and Justin Morrill, as well as by a growing commitment to universal educational access. Under these circumstances, the expansion of the American university was accompanied by an ever increasing diversity. Community colleges, regional state universities, private liberal arts colleges, and research universities emerged, and their educational goals can hardly be expected to be identical. Indeed, they are not. If discussion about higher education is to be meaningful, it is important to understand the perspective one brings to the debate and the sort of institution one is talking about.

In the following remarks, I shall be concerned with the public research university: the large, comprehensive university developed in the tradition of the land-grant institution. I would like to discuss its structure, identify a few of its problems, and propose some changes that I believe could help it preserve the healthy traditions of the past while responding to the changed circumstances of the present and the needs of the future. Clearly, it is not possible to address all the issues that have been raised in connection with higher education, so I have limited my attention to several crucial ones that profoundly affect the role of our faculty and the nature of our curriculum.

Because the United States has no national universities, it depends on a federation of public and private universities to carry out nearly all the basic research and scholarship on which the well-being of society depends. Although these public and private institutions share many characteristics, there are differences between them. For the public institutions, the federation concept implies that, even as they serve an important and appropriate regional purpose, they cannot narrow their mission to the point where they fail in their responsibility to the nation as a whole. In curriculum, for example, the regional mission of large public universities inclines them toward a vocationalism that does not serve the purposes Jefferson had in mind when he conceived of an educated populace as the best guarantor for the preservation of democracy. In research and scholarship, regional missions imply an emphasis on activities that stimulate local economic development or resolve local problems. A university's national responsibility, however, requires that considerably greater attention be paid to the quality of a program than to its specific subject matter. Such quality has a long-term value in the life of a nation, and it needs to be consciously preserved and enhanced because it is fragile.

In addition to the tension of regional and national missions, public research universities differ from their private counterparts (and all but a handful of other schools) by virtue of the enormous number and diversity of their undergraduate students. All such universities enroll more undergraduates than graduates, generally two to four times as many, and their undergraduate populations often number in the tens of thousands. Thus, they are responsible for educating a significant proportion of American youth, and undergraduate education must be an important priority for them. Yet their approach to high quality undergraduate education must reflect and might be expected to take advantage of their status as research universities and of the sheer size of their enrollments. For this reason, their solutions to the problem of providing high quality education will undoubtedly differ from those of other institutions.

As one explores such questions, it becomes clear that there is a certain ambivalence about the role of the public university. The traditional values of the university have usually required that it remain separate from the rest of society. If ideas are to flow freely and if judgments are to be formed on the basis of the logic that inheres in the way problems are approached, and if institutions of higher education are to provide a congenial ambiance for the objective examination and criticism of society, of mankind's understanding of itself, and of the quest for a truth that will remain unconstrained by the prejudices of the moment, then colleges and universities must be at least partially independent from the society and from the immediacy of its problems and needs.

At the same time, the public university must be closely connected to society. Its research should be driven by the needs of society. It should play an important role in economic development. In a very real sense, it is accountable to society, to the states and the federal government which subsidize it. I do not mean that this accountability should interfere with academic freedom, but that the university community is not free to define its mission in disregard for regional and national interests or without consideration for the opinions of those who are not part of the community.

This connection to society is not a simple one, either conceptually or ideologically. For example, responding to the needs of society does not mean that the university is obligated to support the *status quo*. Universities train people to be healthy agents of change. To accomplish this goal, they must provoke an awareness of where change needs to occur. Racism and sexism constitute major societal problems, and the curriculum--the very discussion that occurs within the university--must be weighted to combat the biases with which each of us has been burdened by the age in which we live. Yet if we allow current issues to skew our approach to education such that we lose a more general and timeless perspective or undermine the educational process itself, then we reduce the value of the education we provide and, in that way, reduce the likelihood that those whom we train will be effective agents of change.

In other words, we must distinguish between the role of the university as a laboratory for change and the role of the university in training people to be agents of change once they take their places in society. In my view, we saw more of the former in the sixties and, consequently, did the latter somewhat less adequately. That is, we viewed the university as a laboratory where the structural changes we sought in society could be first introduced. However, the university is not simply a microcosm of the society at large; it is a fragile institution whose effectiveness depends on a careful balance in its structure, an attention to high standards in disciplined inquiry and scholarly intercourse, and a respect for tradition as well as an openness to change. Students prepared in such an institution, when it functions well, will be equipped to be effective in bringing about change. They will have intellectual self-discipline, and they will have a sense of the whole--in time, in space, in thought. They will also have a sensitivity toward the ecology of our society and our culture. They will approach change with respect and understanding, whether it be change that affects our natural environment or change that affects our social environment.

During the 1960s, university faculties and administrations were too often willing to change the structures of the university to demonstrate a point. People were concerned with short-range political effects rather than with long-term educational consequences. In effect, we were diminishing the likelihood of permanent, evolutionary improvement. Casual changes in curriculum, confusing the roles of teacher and student, anti-intellectualism, adopting approaches that were often even more utilitarian than the current wave of vocationalism--all these trends contributed to the problem we are facing today. Thus, an exciting and important era for the nation was a difficult and possibly damaging one for universities.

Many attacks on higher education today represent a backlash against that earlier era. Accusations of moral relativism, historicism, absence of standards, and lack of intellectual rigor are of that kind. Yet there is a serious problem with the accusations: they are advanced as arguments for returning to an even earlier era. In this sense, they are oblivious to the need for our conception of the world (viewed in philosophical and cultural as well as in physical terms) to evolve, just as the movements of the 1960s were blind to the abiding values of cultural and philosophical traditions. The real solutions, it seems to me, lie in accepting the ambivalence of an institution that must be a part of society and yet remain separated from it--an institution that must strive to establish linkages between past, present, and future. In research institutions, where disciplined inquiry is constantly being channeled into a heightened understanding of the world, we must be prepared to incorporate new knowledge into the curriculum. In other words, we must accept the premise of our own research, i.e., the assumption that what we learn might change our views. Generally, of course, new knowledge requires a modification rather than a dismissal of our previous conceptions, and for that reason alone, we will be well advised to maintain a sense of linkage. Furthermore, because research questions emerge from the socio-cultural and institutional matrix of an age, it should be obvious that new knowledge will move in directions that reflect the character of the age.

In the past, it has been commonplace to speak of land-grant institutions in terms of a threefold mission that consists of teaching, research, and public service. These three activities have often been described as the legs of a stool; however, this simile seems flawed to me because it suggests a separateness of function that does not reflect reality. In fact, the great strength of our research institutions lies in the synergistic interactions that they foster in the areas of teaching and research; good research receives stimulus from classroom teaching, and the excitement of cutting-edge scholarship can be conveyed in the classroom by an active researcher. As we think about the future of comprehensive public universities, we must strive to promote this interaction in ways that enhance both the quality of scholarship and the quality of education.

Despite regional and demographic differences in student populations at public research universities, there is clearly a common trend toward greater diversity and increasingly non-traditional patterns of attendance. The four-year, continuous enrollment model of an earlier day has virtually disappeared. At an institution like the University of Minnesota, where only 15 per cent of the students complete their undergraduate work in 4 years, it has become meaningless to identify a student as being in "the class of 1992." Because students "stop out" of school for a quarter or for a year, we no longer have predictable enrollment patterns on which to build an integrated curriculum. Moreover, a heterogeneous student body comprising part-time adult learners, members of minority groups, vocationally or professionally oriented students, outstanding scholars, and many other sorts of people will necessitate the elaboration of alternative ways to provide effective undergraduate education, although the goal of that education may well remain the same for all of these groups. Particularly in this respect, the facile solutions offered by some contemporary critics of undergraduate education are woefully short-sighted.

The enormous expansion in knowledge that has taken place during this century poses another set of issues. H. J. Mackinder, a well known geographer, once said, "all knowledge is one. Its division into subjects is a concession to human weakness." His statement acknowledges human cleverness as well as human weakness in the scholarly enterprise. By breaking very complicated problems into smaller pieces more suited to the capacities of individuals, we have been able to achieve a vastly expanded understanding of nature, and this understanding has enhanced our ability to combat disease and hunger. In fact, most of the great scientific and technical advances of this century have resulted from specialization. And the benefits of specialization have hardly been limited to science. The social sciences, the humanities, and even the arts have adopted the principles of specialization as their practitioners delve more deeply, if more narrowly into every kind of intellectual problem.

Specialization has produced undeniably positive results, but we must also confront the problems it creates. Perhaps it is necessary to learn the pieces of a puzzle one by one, but until we have put them back together again, we have failed to comprehend the total picture contained in the puzzle. Actually, most of us spend by far the greater part of our lives in synthesizing isolated observations, in putting them together. We do so not out of some abstract or aesthetic sense of order but because, in the most practical sense, a discretized model of knowledge is inadequate to the reality of which we are a part.

For example, technology and human behavior constantly interact. It has repeatedly been observed that the very questions we ask in scientific research reflect the context of the age in which we live. Indeed, most of us working in science quickly discover the significant gap that separates idealized textbook descriptions of "the scientific method" from the reality of scientific research. As we moved from the age of exploration through the age of discovery to the information age, the amount of available knowledge changed, but so did the methods, criteria, and assumptions that govern how we seek and assimilate that knowledge and generate new insights. Since the form that answers take will be determined by the questions that have been asked, an understanding of history can offer us useful insights into the likely limitations of the knowledge generated in the past as well as the knowledge currently emerging from our scientific laboratories and testing facilities.

Interactions occur in both directions. In the information age, concepts and language itself have been influenced by the technological developments that are taking place all around us. For example, the word cybernetics was coined in 1948 to describe communication theory rather loosely. In fact, the root meaning of this Greek word is "to steer" or "to control." In a manner peculiar to our age, we have come to think of information primarily in terms of its usefulness as a means of control. This conception of knowledge has far-reaching consequences not only for the structure of society, but also for personal attitudes and assumptions with regard to what constitutes "useful" or "useless" information.

Another example of the information revolution's influence on language is the increasingly widespread use of the word "interface" to describe the point of contact between people, groups, ideas, or fields of study. For me, this word suggests the existence of a barrier between people or things rather than a linkage that connects them. Insofar as "interface" has this connotation, it subtly alters our perspectives on the nature of the transactions it is employed to delineate. At the same time, systems analysis also evolved from cybernetic tradition, and it emphasizes the interconnectedness of all elements in any system. The point is that a genuine understanding of the world requires a broader perspective than that which can be provided by any single specialized field.

If one accepts the argument that technology and human behavior interact and that a proper understanding of the one requires some knowledge of the other, then the artificiality of what is referred to as value-free education becomes obvious. Values are inherent in the practice of any profession. They are intrinsic to policy-making and to assessing the effects or effectiveness of policy. A physician is in the best position to know the risks or benefits that might result from a particular medical treatment. Similarly, engineers and scientists must bear a greater responsibility than others for weighing the positive and negative consequences of nuclear power plant development, sonic boom, acid rain, and other technical developments, activities, or byproducts. If such issues are not addressed as an integral part of their education, they will be unable to fulfill their responsibilities as citizens with relevant technical knowledge. The goal of education in this sense is not to inculcate a particular set of values, but to help individuals see the connections between actions and values and to help them act in ways that reflect the values they hold.

Just as comprehensive research universities need to maintain a careful balance between the close connection they entertain with society that supports them and the necessary distance that separates them from that society, they must resolve the tension between specialization and integration in a balanced way that reflects the legitimacy of both approaches to knowledge. At the moment, the balance in our research universities has shifted unhealthily towards specialization. We should correct this imbalance, but we must do so carefully and with a full recognition of the need for specialization in most disciplines. In my opinion, this situation represents one of the most serious challenges facing American universities today. To address it in an appropriate manner, we must to reexamine the role of faculty, the academic structure, and the nature of the curriculum.

As I suggested above, the university model that holds the greatest promise is one in which teaching and research are intimately related to each other. Researchers should teach and teachers shouuld do research in such a way that each role is strengthened by the other. While most people would endorse this model in principle, we have been less than completely successful in putting it into practice. For example, faculty members tend to define their roles primarily in terms of their research interests and activities; they then develop teaching roles consistent with their research. This situation creates a number of problems. Certainly, the criticism that faculty members may not be spending enough time on teaching may be true in some cases, but there is an even more crucial dimension to this problem, and it affects the very structure of the university and its flexibility to grapple with the kinds of problems raised earlier.

As researchers, faculty members are oriented toward disciplinary peers at other institutions rather than toward their colleagues at the university in which they happen to be working. The excitement of research in their fields is an excitement they share with these peers, and progress in their areas of specialization often results from their joint and interactive efforts. Reputation in their field depends on recognition by peers at other institutions; this fact is particularly important in areas where significant federal funding is required to carry out research, for these peers are the evaluators who make recommendations on the quality of proposals to federal funding agencies. Similarly, good graduate students are attracted to research programs largely because such programs are highly regarded by faculty members.

One consequence of this extra-institutional orientation is the erosion of faculty concern with their own campus. This observation is hardly a new one. University presidents and commentators on higher education have been aware of the situation for many years. However, two aspects of the present environment have drawn increased attention to it. First, universities can no longer expand indefinitely as they appeared to be doing in the recent past; therefore, if programs are to continue to evolve in response to the development of new knowledge, choices will have to be made, and if these choices are to be made rationally through a process of faculty governance, people with different areas of specialization will have to have a shared set of goals, a common purpose that informs their discussions and their decision-making processes. Second, to create a curriculum capable of resynthesizing the compartmentalized knowledge of the various disciplinary fields, faculty members must be willing to implement academic structures that facilitate cooperative ventures and promote undergraduate teaching programs on a truly university-wide level.

The primacy of disciplinary research has taken its toll upon the organizational structure of the research university. The fundamental administrative unit has become the disciplinary department. It constitutes a convenient geographical cluster within the university, providing specialized support services, library materials, and opportunities for dialogue with people whose work is closely related to one's own. All of this makes good sense. The disciplinary department is also the unit in which promotion and tenure decisions are made, salary increases set, and the nature of the curriculum defined. Obviously, this system has great strengths. However, the tyranny of departments within universities makes it difficult to address broad questions of curriculum revision except as minor modifications to essentially disciplinary programs. Furthermore, even where experiments that carry curriculum beyond disciplinary boundaries are successful, no structure exists to nurture and protect them as permanent programs and their continued existence may may well hinge upon the enthusiasm and energy of a single faculty member.

Yet departmental primacy does not affect only the curriculum. It also tends to discourage multidisciplinary scholarship--efforts that bring together individuals with strong, complementary disciplinary affiliations to work on a common problem. A great synergy frequently occurs in such interactions, and in many instances, the most exciting and creative advances in knowledge have resulted from them. As with curriculum, the lack of university structures to promote such interactions renders them both difficult to sustain and risky for the faculty member whose rewards are determined on the basis of contributions to a disciplinary department. Ironically, the research emphasis that leads to strong departmental structures may well be discouraging what are potentially the most productive research collaborations in the university.

For this reason, the university of the future will have to find ways of creating and supporting centers for multidisciplinary research, not to replace departments, but to complement them. These centers should foster and reward interaction without evolving into new kinds of departmental structures. At the moment, such centers tend to be created and sustained by graduate school deans or academic vice presidents. But they will never survive unless departments and faculty members identify with them and support the work in which they are engaged.

Another consequence of defining faculty members' roles primarily in terms of a research orientation is that teaching comes to be regarded as merely an adjunct to research. If a faculty member is a psychologist in a department of psychology, for example, he or she will be expected to teach only psychology. Indeed, if the person's field is vision research, he or she may only be expected to teach courses closely related to vision research. Particularly in a public university with large numbers of undergraduate students, this rigid coupling of research and teaching can limit the institution's capacity to meet the needs of its students and still pursue exciting new research areas.

To overcome this dilemma, universities of the future must be able to hire and retain faculty members who are willing to uncouple their research interests and their teaching assignments. This should certainly be possible in introductory courses, but professors can also be encouraged to participate in teaching more advanced courses somewhat removed from their major research interests and even from their traditional disciplinary specializations. Because a more conscious effort will be required to prepare for such courses, better teaching is likely to result. This kind of flexibility should allow the university some leeway in setting research and teaching priorities. It will facilitate the process of designing a curriculum that meets the needs of undergraduates without impairing the university's capacity to undertake research at the forefront of disciplinary inquiry.

Such a system would have a salutary influence in the integration of teaching and research. On the one hand, researchers with a wide variety of interests could bring their insights and knowledge to bear on the subject of a specific undergraduate-level course, thereby enriching the course for students as well as for other faculty members. On the other hand, the obligation to prepare classes in a field that is related to but not identical with one's research specialization could provide a fresh context within which to evaluate the outcomes of one's own scholarly efforts. A faculty member undoubtedly receives some gratification from teaching extended seminars that deal with his or her own research to students who have already been conditioned to accept his or her own way of thinking, but such activity is unlikely to generate the kind of synergism that is produced by the interaction of teaching and research at its best.

One of the most disturbing elements in the current debate over higher education is the widespread criticism leveled at the undergraduate curriculum. This criticism is disturbing for several reasons. First, it does have some validity. Over the years, the undergraduate curriculum has evolved in a piecemeal fashion, responding to specific problems and needs without developing any overall sense of purpose. For example, society's demand for practical education accompanied society's push for increased access and has resulted in a more vocationally oriented curriculum. Successful research programs have been allowed to define not only the content of advanced undergraduate courses and, in some cases, introductory courses as well, they have also played an important role in determining the very structure of the curriculum. At the same time, undergraduate course offerings have often been used to make statements about our concern for social and economic justice. While each individual action might well be justified as a desirable response to a real issue, the integrity and cohesiveness of the curriculum has frequently suffered in the process.

Second, criticisms of the undergraduate curriculum are disturbing because education at this level is such a central function of the comprehensive research university's mission in society. If the university fails to educate adequately the vast numbers of students who enroll in its programs, the effect on the country will be substantial. No amount of success in its other endeavors can possibly compensate for a failure in this area.

Third, while formal education is a continuum that stretches from preschool activities to post-doctoral study the undergraduate years are crucial in terms of their contribution to an individual's intellectual growth. During these years, the educational process should be aimed less at conveying facts than at broadening the student's perspective and at fostering a sense for what is possible and desirable. The undergraduate years should stimulate inward discovery as much as outward discovery. If the university fails students during these years, its failure does more than leave a gap; it undermines the entire premise that education is both a key to the preservation of democratic government and a basis for personal, intellectual and moral growth.

For all these reasons, we need to reexamine critically the goals and structures of undergraduate education in the United States. Yet it is equally important to eschew overly simplistic solutions to complex problems, as many critics of higher education appear to be doing in the current debate. In my opinion, the undergraduate curriculum must emphasize the intellectual process. It must encourage students to pose questions. It must sensitize them to connections between values and actions. It must awaken them to the interrelationships that exist among the parts of knowledge. Indeed, it must prepare them to cope with a multitide of such issues.

Generality and breadth are thus necessary attributes of the undergraduate curriculum, for they provide students with larger perspectives on the specializations required to undertake effective modern inquiry. Precisely because undergraduate education should be a time of discovery, the curriculum should be structured in such a way that students are not encouraged to make binding career decisions before the process of discovery has taken place. Particularly at large comprehensive universities, we need to resist the administration's propensity for categorizing students and the departments' desires to attract them prematurely into disciplinary specializations.

However, generality in the curriculum has its own pitfalls. As valuable as breadth, integration, and synthesis are, they serve little purpose if we have failed to provide students with that which they are called upon to integrate or synthesize--knowledge itself. Generality can encourage superficiality and minimize the intellectual self-discipline necessary for putting education to practical use. The blurring of distinctions between teachers and learners and the proliferation of courses that teach about subjects rather than teaching the subjects themselves have bred a lack of respect for knowledge. While in-depth understanding of a subject does not require blind acceptance, any attempt to manipulate knowledge without understanding it is likely to produce the results of a sorcerer's apprentice.

The need to transmit a body of knowledge and the need to teach students how to use that knowledge place an enormous burden on the curriculum--a burden that becomes intolerable if students lack the necessary preparation when they arrive at the university. Therefore, successful undergraduate programs will, in the future, have to rely more heavily on the quality of the high school preparation received by their students. Large public universities can influence this preparation because a large proportion of high school students continue their educations at such institutions and large numbers of high school teachers receive their training at such institutions. Under these circumstances, public universities should assume a more visible leadership role in developing partnerships with secondary schools. As its contribution to this partnership, the university should 1) clearly define the basic knowledge students will have to acquire if they expect to succeed in doing college-level work and 2) offer appropriate assistance to secondary schools in conveying that knowledge to students.

At the university itself, there is a great deal of attractiveness to the core approach. Certainly, a core curriculum helps address the need for breadth and integration in undergraduate education. There has recently been considerable debate about the most appropriate content for such a core. Voices have been raised to defend the idea that the core should continue to be based on an immutable group of great works capable of acquainting students with the essence of Western culture. The preservation of our cultural heritage is an appropriate part of the university's mission, but excessive rigidity in maintaining a traditional set of readings unnecessarily restricts the contributions the university can make to the intellectual growth of its students. Nevertheless, ongoing faculty discussion is capable of producing a dynamic, gradually evolving core curriculum that can continue to serve as the centerpiece of undergraduate education in many kinds of institutions.

However, the core curriculum concept has only limited applicability in the comprehensive public university. In the first place, the enormous diversity of undergraduate programs provided by such institutions makes it impractical (and probably inadvisable) to define a single core. In the second place, a core curriculum is based on a sequencing of courses. This sequencing is incompatible with the irregular pattern of attendance that now characterizes most state universities. Students "stop out" of the university and later return on an irregular basis, placing severe contraints on the institution and compelling it to offer courses that are not too rigidly linked together and sequenced.

Yet the integrative characteristic of a core curriculum can still be achieved through the imaginative design of individual courses or small clusters of courses. Emphasis should be placed less on a common body of knowledge or on a particular cultural tradition than on the need to relate different intellectual traditions--different disciplines--to a specific problem or a general area of interest. How practical is such a micro-integration of the curriculum? Elements of this approach are already present in the existing undergraduate curriculum. For example, many institutions have found it impractical to use single courses to satisfy the needs of majors in different disciplines; as a result, these universities offer several renditions of the same course. Such a strategy could easily be reoriented to emphasize the integrative process rather than simply to provide palatable ways for different majors to satisfy the same requirement.

Public research universities are complex and, despite their size, quite fragile. Their success depends on an appropriate balance in their activities and on a sensitivity to the interrelatedness of their various missions. They will be able to preserve their traditions and meet their goals only if they consciously participate in an evolution that will proceed whether or not they acknowledge it. At the present moment, the process of change seems to be accelerating because society has begun to focus its attention on universities and to criticize what it has perceived in recent years as "drifting." The present debate is certainly evidence of this increased scrutiny, and if it prompts the universities of the future to become what they are capable of becoming, we may well come to view it as a sign of health rather than as a symptom of crisis.

From the Tower to the Trenches

Dorothy Nelkin

Some time ago the *New York Times* ran an article in its business section on the current science policy of the National Science Foundation under the leadership of Eric Bloch. It was headlined "Pushing Ivory Tower Scientists Into the High Tech Race." The image of the university as an ivory tower is an ambivalent one. On the one hand, an ivory tower is defined in *Webster's Dictionary* in a rather pejorative tone as "an often unrealistic and studied aloofness and lack of concern with practical matters; a preoccupation with what is speculative, theoretical or abstract; a place of retreat from reality and practical issues." On the other hand, it is precisely this ivory tower image of the university as a disinterested and abstract institution working in the spirit of free inquiry that has given it considerable privilege and substantial influence. The American university, after all, has historically been provided with generous public support with less public accountability than other institutions. It has been able to exert some influence, yet operate with relatively limited external control.

It is perhaps useful to look back to the origins of the university's rather unusual position as an autonomous, self-governing institution. Walter Metzger, who has written extensively on academic freedom, points to a 1915 report by the newly formed American Association of University Professors as the document that crystallized the concept of academic freedom and set the tone of university culture. This document focused on several questions: to whom does a university belong? who are the clients of the faculty? in whose behalf do university trustees hold their trust? The AAUP argued that the trustees were not the agents of the university benefactors, but the agents of the general public; that the academic profession serves not only the student, but also the "public agency in need of expert guidance, and the general society in need of greater knowledge; that the latter clients have a stake in disinterested professorial opinion, stated without fear or favor, which the institution is morally required to respect. . . ."[1] This influential statement

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contributed to the development of norms and practices within the university that protected the faculty and its freedom of inquiry. It also encouraged, indeed placed considerable value on, open communication and public service. Moreover, its assumption that the university exists to serve the interests of the general public, rather than interests of particular groups, helped to reinforce the autonomy that this institution has come to expect.

This essay deals with the impact of contemporary patterns of scientific research on these traditional assumptions and their implications for the university in the twenty-first century. It focuses on three important developments in the support and organization of science and technology in American universities. None of these developments is really new, and none by itself would necessarily be significant. It is their scale and their convergence in recent years that makes them so important to the university.

The first development is a change in federal funding policy towards an emphasis on large-scale engineering research centers devoted to commercially applicable work. The intent of the policy is to engage the university in the national effort to strengthen international industrial competitiveness. The plan is to seek additional funding for these centers from American corporations. This NSF policy is based on the not-so-new assumption that what is good for General Motors is good for the country. Thus, a major block of science research support is directly tied to the interests of the corporate sector.

The second development in academic Research and Development is the increase in Department of Defense funding. Government grants to universities for Research and Development increased under the Reagan administration, and much of the increase reflected the interests of the Department of Defense. Department of Defense contributions to universities increased from $457 million in fiscal 1980 to $932 million in fiscal 1985. Today about 16 percent of all federal funds in universities comes directly from the Pentagon, and other programs also reflect Department of Defense interests. This is suggested by the tilt towards physics and engineering and away from biology and the health sciences.

The third development involves increasing ties between industrial and university research. Industry funds going to universities to support Research and Development rose from $84 million in 1973 to $370 million in 1983. Many observers have remarked on the proliferation of industry-university alliances. These have mostly focused on two areas of cutting-edge technology--computers and biotechnology. A study of these alliances for the National Academy of Sciences Government-University-Industry Roundtable found considerable diversity.[2] Different programs vary in their goals, in their structure and organization, and in their relationship to university culture. But in all cases they have evoked discussion and debate about their effect on the university environment. These industry-university arrangements are not necessarily new; industry has long had a presence in many American universities, especially in engineering schools. What *is* new in the last decade is that these alliances are now strongly encouraged by federal initiatives (e.g., the Patent and Trademark Amendment Act and the Stevenson/Wydler Technology Innovation Act of 1980), and that they are of a scale that can affect the organization of university research, and the nature of research priorities and practices. Moreover, the industrial interests reflected in these new arrangements have converged with federal policies for defence research and the encouragement of commercially focused research centers. Combined, these developments are pushing universities towards highly focused goal-directed activities, towards situations where secrecy or proprietary practices are increasingly common, and, generally, towards a set of values that are influenced by a managerial and corporate mentality.

This mentality is fostered by yet another trend--the corporate culture that has increasingly pervaded all American institutions, including art museums, which are finding it difficult to locate museum directors. According to the former director of the San Francisco Museum of Modern Art, the problem of finding museum directors can be attributed to the fact that "the museum board has become like a business board room, a competition among men of wealth and power. What transpires now is that 11 businessmen in the boardroom speak the same language automatically as the administrative head of the museum and don't speak the language of the director. So, if it becomes an issue of program or money, money always wins."

What, then, are the effects of these developments on the university? It is probably too early to make a long-term prognosis. Those who support these changes argue that the new programs promise to invigorate universities by increasing budgets and by reducing the academic isolation that has pejoratively been associated with the image of academia as an ivory tower. Others, however, worry that the new relationships are bringing commercial values into university life, affecting the way basic research priorities are set, tangling universities with proprietary constraints, and generally changing the nature of the university culture. These are clearly important issues to review.

In the academic community it is assumed that research priorities should be set by working scientists themselves on the basis of criteria internal to their field. The ideal is that the university, in the spirit of free inquiry, should be a self-governing community of scholars contributing to the public store of knowledge about a set of questions selected because of their intrinsic scientific interest.

In the real world these ideals, of course, are always compromised. Since World War II, basic science in universities has been sold politically to the American public and to Congress mainly in terms of its practical benefits. Concern with practical problems has always had profound influence on the allocation of public monies in most fields of research. Conversely, the availability of money has always affected research priorities. Just recall the fictitious character of the 1960s, Dr. Grant Swinger, who perpetually shifted his research according to the availability of support. Yet, the new developments do appear to represent a significant change in the influence of commercial and mission-oriented values on decisions about research priorities. It is likely that those areas of science that have no short-term commercial application will face declining support.

As for proprietary constraints, there are many who fear that new research initiatives will change the spirit of open communication that has in the past been important both to scientists and the larger university community. Recent developments in university Research Development frequently involve agreements that put constraints on publication rights; for example, industry-university contracts allow for delays in order to assure that patent applications are filed where appropriate. Universities have established contractual limits on permissible delays, and these vary greatly, ranging from 30 days to more than a year.

Far more worrisome than these contractual constraints on publication is the atmosphere of secrecy and confidentiality often associated with working on corporate or military-financed projects or on research under any auspices where there is a potential for commercial application or military sensitivity. Many academic leaders have expressed their concern about secrecy in the competitive field of biotechnology. But it is also of concern in areas of research that have been deemed by the government to be "militarily sensitive." The last years have seen a persistent tendency to extend national security restricitions to non-classified research. Academic scientists have found themselves snared by information policies developed to protect the leakage of commercial or military technology and related ideas. There is talk of self-censorship as scholars, unsure of the status of their work, seek to avoid external interference by avoiding communication. Universities have found themselves faced with demands to limit the access of foreign students or visitors deemed to be a security risk. The encouragement of commercially-directed high-tech Research and Development and the increase in Department of Defense and mission-oriented funding encourages research in precisely those areas that can be defined as militarily sensitive and therefore subject to national security controls.

Once again one might ask, "so what is new?" Struggles for priority in research have always constrained communication and encouraged secrecy. And some proprietary constraints imposed by sponsors of research on scholarly communication have been around for a long time. But the scale of recent changes has sharpened their impact. The extent of these constraints and their actual costs to the university and to scientific progress is, of course, debatable, but clearly they are worth careful consideration.

Beyond their influence on research priorities and open communication, changing research practices can affect many other aspects of the university culture--for example, the balance between research and teaching, and the distribution of faculty among disciplines, both within science and between science and the humanities. The availability of military and corporate funding can encourage the hiring of faculty in substantive areas which may not match the long-term educational priorities of liberal arts institutions. Recruitment criteria are clearly influenced by the need to support a costly research enterprise. Many science employment ads these days explicitly require "proven ability to generate grant support, " in effect setting new entrepreneurial professional standards for academic employment.

The focus on funding is also reflected in the striking expansion of university public relations activities. Universities are behaving as if corporate sponsorship and large-scale government funding depend in large part on a favorable public image. The quest for media publicity is a growing part of the university culture. Journalists refer these days to "press conference science," suggesting that, in its quest for image, academia is out for "hype." Public relations, in effect a form of advertising, tends to emphasize the spectacular promises of research, the "breakthroughs," the dramatic discoveries, in order to attract external funds. It is not clear that this hype is, in the long run, good for either universities or science.

The status of individual faculty within the university may also rest on their ability to generate external funds. University administrators struggle with the problem of growing salary differentials that follow from the effort to keep "stars" in well funded research areas. Some observers believe that the new corporate-funded centers are distorting the traditional process of allocating faculty appointments, affecting the education of students as well as the priorities of research. One wonders whether great liberal arts institutions are in fact turning into technical universities in which the humanities are but service sectors to the technical elite.

As universities become increasingly dependent on industrial and military support, they risk eroding the tradition of academic freedom that has allowed scholars to speak out on public issues with immunity. Can those who depend on Department of Defense or corporate funds take a position against Pentagon policies or corporate practices? Or are they likely to censor themselves?

Finally, the flow of funds to large-scale research facilities is reflected in many universities in very extensive construction and the purchase of costly equipment. What will happen if the spigot is turned off? The scale of its commitments leaves the university vulnerable. In the 1960s, when military priorities changed and the Mansfield Amendment, requiring all Pentagon-funded research to have direct military applications, the university was left with a moral dilemma. Military funds can at any time be narrowly targeted toward short-term military goals. The dependence created today could leave the university in a weak negotiating position, that is, less able to control the terms of its future contracts.

In trying to assess the overall impact of these changes on the university, one soon discovers that those immediately involved in new science and technology endeavors have a rather narrow vision. They see the advantages of greater research support for their own projects, but are seldom able to see the cumulative effect of the many converging developments on the university environment. To assess these effects, we must ask several critical questions: is the redirecting of large areas of academic research towards commercial goals really in the long-term interest of the general public to which the university is ultimately responsible? and is this transformation of science in the interest of the academic community as a whole? if the university's traditional autonomy has rested on its contribution to the general public interest and its image as a disinterested source of knowledge, what will be the impact of its growing ties to the corporate agenda? As academics move from the tower to the trenches in the twenty-first century, it seems quite likely they might lose the privileges of autonomy and academic freedom that they have traditionally enjoyed.

Notes

[1] Walter P. Metzger, "Academic Freedom and Scientific Freedom," in Gerald Holton and Robert S. Morison (eds.), *The Limits of Scientific Inquiry* (New York: W.W. Norton, 1979), p. 98.

[2] Dorothy Nelkin and Richard Nelson, "University Industry Alliances," *Science, Technology and Human Values* 12: 1987, 65-74.

University-Business Partnership for Economic Development

Angel G. Jordan

In the United States a number of initiatives have been undertaken by research universities in conjunction with industrial corporations. Sometimes these initiatives have been partially supported by the government. Many of these cooperative arrangements have been implemented to foster technology transfer as well as the creation of new enterprises and jobs.

In shaping these relationships, one must remain aware of the innovation matrix as a framework for the establishment of policy. There are four stages in the classical, linear model of the innovation cycle: Research, Development, Production, and Distribution. Performance at each of these stages is in turn affected by four factors: science and technology policy, management skills, macroeconomic policy, and sociotechnical factors.

In the World System, the United States excels in Research and Development. At present, Japan and other nations in the Pacific Basin excel in Production and Distribution. This observation holds true with regard to both products and processes. Within the American system, states like Massachusetts and California excel in Research and Development, but they also do well in Production and Distribution. My own state, Pennsylvania, excels in Research and Development; it is also taking vigorous steps to improve its performance in Production and Distribution. North Carolina and Texas are adopting Research and Development from other states and emphasizing Production and Distribution. All of these states are establishing policies to accelerate the motion through the different stages of the innovation cycle. In fact, the entire country is now preoccupied with the innovation matrix as we seek to accelerate the transition from state-of-the-art science and technology to practical application. The European Community is aware of a supposed technology gap between Europe, on the one hand, and the United States and Japan, on the other; and it is taking vigorous steps to close the gap.

Within this context, Carnegie Mellon University has developed considerable expertise in fostering industry-university collaborations. It is not the only institution in the United States (or Europe) that fosters such collaboration, but it has been particularly visible on the national and international scene as a successful example of fruitful industry-university relations. At Carnegie Mellon, the objective of such collaboration is generally technology transfer. Sometimes advanced forms of technology exist in university laboratories, waiting to be transferred to industry. Sometimes they are already available to industry, but they must be perfected through experimentation carried out at the university. In the latter case, the focus on existing technology is often the driving force for new research, which in turn triggers new developments at the university and suggests new possibilities for production and distribution in industry. In this way, the innovation cycle is amplified as the result of the ongoing interactions between industry and the university.

Many centers and institutes at Carnegie Mellon are involved in university-industry collaborations that emphasize technology transfer. They include

1) *The Magnetics Technology Center.* This center is funded by agencies of the federal government and a consortium of companies interested in magnetic technology. The companies participate in the Center either as industrial associates or as industrial affiliates. The associates provide high levels of funding and send technical people to work alongside faculty and graduate students in the Center for extended periods of time. Such people enhance the work of the Center by contributing their own expertise and non-proprietary technology. Affiliates provide lower levels of funding, but they too support its work and benefit from the generic Research and Development carried out there. For more than 10 years the Center has been a primary source of magnetic technology transfer from the university to industry. Nationally and internationally recognized for its role in the innovation cycle, it is regarded as an exemplary model of university-industry collaboration.
2) *The Iron and Steel Making Center.* This center emphasizes modern techniques and processes in iron and steel making. One of its objectives is to help revitalize the American steel industry. It operates in a fashion similar to the Magnetics Technology Center and transfers the results of its Research and Development efforts to sponsoring companies.
3) *The Pittsburgh Supercomputer Center.* This center links Carnegie Mellon with the University of Pittsburgh and Westinghouse Electric Corporation. One of five supercomputer centers funded by the National Science Foundation, it also receives funding from the state of Pennsylvania. Its primary objective is to promote advances in scientific and engineering computing. Like the

Magnetics Technology and Iron and Steel Making Centers, it has industrial affiliates who benefit from the technology transfer it fosters.

4) *The Software Engineering Institute.* A Research and Development center funded by the Department of Defense, the Institute has the mission of accelerating the transfer of state-of-the-art software technology into the realm of practical application. Although it is a division of Carnegie Mellon University, the Institute collaborates with a large number of industrial affiliates and other universities, both of which send technical staff to work alongside full-time researchers at the Institute for extended periods of time.
5) *The Mellon Institute.* This institute is entirely devoted to industrial research that is sponsored by private companies. All the researchers at the Institute work full time on Research and Development projects funded by these companies. Faculty members from various academic units in the university participate on a part-time basis, bringing insights acquired in their basic research to bear on industrial projects and thereby actively promoting technology transfer between the university and industry.
6) *The School of Computer Science.* This school is one of the strongest computer science academic research units in the world. Its areas of emphasis are: Programming Systems, Software Engineering, Computer Systems (and Computer Hardware), Theory of Computation, and Artificial Intelligence. Well funded by federal agencies, it is also supported by private companies through industrial affiliate programs in various areas of specialization. This school has been the source of numerous spin-off companies in software and artificial intelligence. It has also acted as a magnet, attracting a substantial number of companies to the region. These companies were formed or attracted to the region because of the work being conducted in the School of Computer Science at the University, once again illustrating the role a university can play in technology transfer. Furthermore, early breakthroughs in Artificial Intelligence and Software Technology took place in this school, and they influenced developments in other parts of the university, particularly in engineering departments, in the cognitive and social sciences, and in the Engineering Design Research Center (an engineering research center that is also funded by the National Science Foundation and private corporations). The School of Computer Science at Carnegie Mellon also provided

the impetus for the creation of the Robotics Institute.

7) *The Robotics Institute.* Formed in 1979 to promote advanced work in Robotics and Intelligent Systems, this multidisciplinary Institute presently employs 120 researchers. It also attracts participation from faculty and students in Computer Science, Electrical and Computer Engineering, Mechanical Engineering, Civil Engineering, Chemical Engineering, and Industrial Administration. Like many of the other centers and institutes at Carnegie Mellon, it has a number of technical staff personnel from sponsoring companies, and they work alongside full-time researchers, faculty, and students from the university.

In addition to the benefits that accrue to industry and to the university as the result of such collaborative arrangements, the Research and Development carried out at Carnegie Mellon promotes local, regional, and national economic development, while it at the same time creates and disseminates knowledge, which is, after all, the primary mission of the university. The university has contributed to economic development through its sponsorship (in collaboration with the University of Pittsburgh) of the Western Pennsylvania Advanced Technology Center, one of the four advanced technology centers that has been created in Pennsylvania under the Ben Franklin Partnership Program. The objective of this program is to foster economic development in the surrounding region by creating and retaining jobs through transfer of technology to the workplace; it is expected that this process will also result in the creation of new enterprises. The magnitude of this effort is suggested by the fact that Carnegie Mellon's share of state funding (about $4 million) has already been matched with approximately $10 million in corporate contributions. Most of the participating corporations are small, but they are confident of reaping the benefits of new technology as it is transferred from the university to the private sector. Although the overall level of funding is still relatively small when compared with total Research and Development funding at the University (about $125 million a year), it is unique in the sense that it is specifically targeted to help bring about economic development.

Together with the University of Pittsburgh, Carnegie Mellon also sponsors the Enterprise Corporation, a non-profit organization funded by private foundations, the Allegheny Conference on Community Development, and the Western Pennsylvania Advanced Technology Center. The mission of this organization is to assist entrepreneurs in starting new businesses. To this end, it offers workshops and seminars on entrepreneurship, provides consulting to entrepreneurs on an individual basis, and introduces them to sources of venture capital and other forms of financing.

In addition, Carnegie Mellon is active in the Pittsburgh High Technology Council, a trade association comprised of business, university, and community leaders who are interested in fostering the growth of advanced technology companies in western Pennsylvania. Together with the Penn Southwest Association (a marketing organization funded by the Allegheny Conference on Community Development), the Pittsburgh High Technology Council is helping to revitalize the region by changing its focus from smokestack industry to high technology. What is striking about this association is that its original leadership and the inspiration for its creation came from the University.

At the present time, Carnegie Mellon and the University of Pittsburgh are undertaking the formation of the Pittsburgh Technology Center on a site formerly occupied by an obsolete steel mill. This center will be a high technology park, and one of its principal buildings will provide expansion space for Research and Development activities that the university carries on in close collaboration with industry. Other buildings will be occupied by corporations that wish to interact with research centers and institutes at the University. This new center is expected to be the source of significant economic development in the Pittsburgh area.

On the basis of the preceding discussion, I believe one is justified in drawing the following conclusions:

1) As primary sources in the creation of knowledge, research universities can play an important role in economic development.
2) Although the primary mission of the university is the creation and dissemination of knowledge, this mission is not distorted by engaging in university-industry collaborations and alliances.
3) University-industry relations can accelerate the transfer from state-of-the-art technology to practical applications.
4) Through university-industry relations, the innovation cycle can be accelerated.
5) A model for successful university-industry relations has been developed by Carnegie Mellon; the benefits of adopting such a model can be readily perceived in the areas of technology transfer and regional economic development.
6) The emergence of numerous spin-off companies that utilize technologies developed at the university is beneficial for both the university and for private industry, especially in light of the fact that these new companies tend to maintain close relationships with the university.

Higher Education: A Capital Investment

John R. Haire

More alumni are giving more money to more American colleges and universities than ever before. In 1987-88, the latest year for which figures are available, they gave more than $2 billion to American colleges and universities. The business community gave almost as much--just over $1.8 billion. In fact, during the academic year 1984-85, corporations contributed more than the national alumni body and might well have remained in the top spot if it had not been for remarkable surges in individual giving in the following two years. Altogether, corporations and the rest of the private sector provided an estimated $8.2 billion in gifts to colleges and universities in 1987-88.

The fact is that the corporate community has suddenly become an equal partner with the other major donor groups--graduates, friends, foundations--in the support of higher education. This phenomenon is relatively new, according to the Council for Aid to Education (CFAE), which keeps track of statistics on these matters and releases its latest research findings from time to time. For the first 20 years after CFAE began studying educational philanthropy during the 1950s, business' share of total private support for American colleges and universities remained in the 10-percent to 15-percent range. Then, in the 10 years following 1975-76, corporate contributions to higher education more than quadrupled, to almost 25 percent of total gifts received from all sources. And despite persistently sluggish profits, business giving in this sector surged 138 percent between 1980-81 and 1987-88.

But these figures include only support flowing from corporate foundations and from gifts officially recorded as charitable contributions. Research arrangements between corporations and universities are generally supported by Research and Development budgets. They now amount to more than $700 million a year. Many millions more are spent on training programs conducted for companies by colleges. In addition, business often awards scholarship grants directly to individuals (rather than via the colleges) and provides various other forms of indirect support.

Why are corporations giving $1.8 billion or more to colleges and universities in addition to their contractual dealings with them? Clearly, management is not spending these sums just to burnish its reputation for "social responsibility." What is happening is that corporate support for education is increasingly becoming an investment decision.

In 1940, higher education was for the few; less than 15 percent of high school graduates went on to college. Essentially elitist, it was paid for by tuition (several hundred dollars at most), private donations, endowment earnings, and state grants. World War II--and the GI Bill of Rights--revolutionized this situation. A national consensus emerged around the unprecedented notion that *all* Americans had a right to higher education. In 1940, approximately 1.5 million--1 in 7 of all men and women in the 18-24-year-old group--went to college. Today more than 50 percent of high school graduates, along with increasing numbers of young adults even senior citizens, are involved in formal post-secondary education. That amounts to more than 12 million people and involves institutional expenditures of more than $120 billion.

The revolution in college-going reflects a change in the American economy. A brawny industrial enterprise based on coal, steel, oil, and armies of blue-collar workers is being transformed into an "information society." The prototypical American working man is gradually being replaced by "knowledge workers"--women and men--who must adapt to rapid technological and social change.

There are several principal rationales for educational support; the relative importance accorded to them may vary from one company to another, but they seem to be very widespread if not universal, even though they may not always be explicitly articulated. These rationales involve human resources, the advancement of human knowledge, and respect for the role played by higher education in enhancing the quality of life in this country and throughout the world.

Number one--and by all odds the most important--is the question of human resources. After all, the modern corporation is essentially a group of people engaged in a common enterprise. Although the value of those people is not capitalized and recorded on the account books as if they were physical assets, the knowledge, experience, abilities, skills, and other qualities of a corporation's people are truly its most valuable asset. For this reason, it is a matter of crucial importance for corporations to assure a pool of qualified people to replace the seasoned people who leave the company due to old age, death, and other causes.

Where can one find this reservoir of qualified young people? How can any company be certain that there will be an adequate supply of individuals with the skills and abilities it needs? And what can it do to insure that it will be able to find new people when it needs them, in appropriate numbers and with the requisite skills? For most companies the answer is clear: higher education.

In somewhat more concrete terms, it is clear that higher education is virtually the sole source of newly educated young people with the professional, technical, and managerial skills that corporations need. Thus, it is clear that corporations have an important stake in the vigor and quality of higher education. If the recruitment effort is to have any chance of success at all, institutions of higher learning must have the resources they need to produce the educated young people that business requires. And because other sectors of society also need educated people, business must compete for its share of the available supply.

So corporations give to colleges and universities partly to help insure that there will be a steady stream of potential employees. In this regard, it is not surprising that individual companies tend to give specifically to those institutions from which they have recruited, or are currently recruiting, most of the new personnel they hire. Such support of higher education is an investment that yields a high rate of return in the form of educated people. It can thus easily be justified as a wise expenditure of corporate money.

The second rationale for educational support of colleges and universities has to do with the advancement of human knowledge through basic research. Institutions of higher education not only disseminate the knowledge inherited from the past but also increase that store of knowledge. Universities are communities of scholars who characteristically possess the ambition, talent, and curiosity to pursue this new knowledge, and the campus provides an environment in which their research can flourish better than in any other setting.

Gains in human knowledge are the fruit of such research. From these gains in knowledge come the new ideas which practical-minded individuals can mold into products and processes of direct, tangible benefit to business and to society as a whole. Just as it needs new educated employees, the corporate sector is dependent upon new ideas for long-term growth. The acceleration of technological progress in nearly every field of human endeavor has placed a premium on innovative research that holds out the promise of improved materials, processes, and products. Such developments are important not merely as a response to consumer demands and to the need for increased productivity, but also as a contribution to competitive excellence in national and international markets.

Applied research and development are made possible by the fallout from basic research. Since a very high proportion of all basic research takes place on university campuses, corporate support for higher education can be viewed as an investment that yields a high rate of return in the form of new knowledge and new ideas.

The third rationale for corporate support of higher education has to do with the public-service functions of colleges and universities. Some of these functions are well established and conventional, such as the operation of hospitals, the sponsorship of recreational and cultural programs, and collaboration with various kinds of applied research centers. In recent years, however, colleges and universities have entered new areas of community involvement that relate to pressing social problems, ranging from the provision of special facilities like day-care centers to the establishment of programs for the foreign-born, the aged, and the handicapped. Colleges and universities are now providing assistance in urban planning and rehabilitation; they offer advisory services for small businesses, help establish new medical and dental clinics for low-income families, and assist in the preservation of historical structures.

Many of these public-service functions resemble the activities that have come to be expected of business under the rubric "social responsibility." To the extent that the self-interest of the business community motivates it to become involved in these areas, it will discover clearly defined advantages to supporting universities in cooperative projects and programs. By participating in such efforts, businesses can effect economies of scale, avoid inefficiencies of duplicated effort, and take advantage of the expertise that exists on college campuses. There is a positive public relations value in being associated with successful programs that are responsive to community needs, and corporations strengthen their other relationships with universities by collaborating with them in such matters.

There is also the issue of the cultural, social, economic, and political, environment that prevails in society at large. This question suggests the fourth rationale for corporate support of higher education. Universities help insure an adequate supply of talent for the nation and the world--statesmen and journalists, musicians and historians, community leaders and theologians, painters and anthropologists, astronauts and philosophers, doctors and professionals in all fields. Such people are essential to maintaining a high quality of life in any society.

The vitality and quality of higher education itself may well represent the greatest long-term benefit that higher education offers to private enterprise in a free, democratic country. The needs of business are not completely met when colleges and universities merely generate a supply of educated men and women, undertake basic research, and offer opportunities for shared responses to the public service demands of society. Diversity must be maintained if these functions are to be performed well in a free and variegated society.

One of the great strengths of higher education in this country resides in an extraordinary diversity of institutions: large and small, public and private, religious and secular, technical and general. This variety reflects the pluralistic character of our society. It breeds academic competition in terms of standards and performances; furthermore, it enables the academic community to respond effectively to the diverse demands and interests of its constituencies. If this diversity is to survive, colleges and universities must remain free from external control and from the arbitrary dictates of governmental bureaucracy. The key to such continuing independence lies in the diversity of the sources of educational funding. Corporate support of higher education contributes to the preservation of institutional freedom by providing an alternative source of support.

Finally, it is important to realize that the educational profile of the overall population has much to do with the environment in which business must function. From this perspective, higher education serves as a stimulus to economic growth and development, it enhances standards of living, and it contributes to the formulation of political arrangements that govern the relationships between business and the rest of society. The climate in which business operates is, in part, a product of the social attitudes toward business in general and toward the conduct of corporate enterprise in particular. These attitudes reflect both the level and quality of education in the population at large. A university education illuminates the relationships between the economic system and the political structure, and it clarifies ways in which society attains the goals set by its citizenry. The more free the educational establishment is to foster objectivity rather than promote dogma, the more likely it is that prevailing social attitudes toward business will be conducive to the maintenance of free enterprise. The ideals fostered by higher education determine the kind of society people will desire and the means they will choose to preserve it. Business has an obvious stake in the outcome of this determination, and one of the channels through which it can infliuence that outcome is through support of colleges and universities.

Few people seriously contest the statement that American higher education leads the world--in vitality, diversity, and independence, in quality of scholarship and research, and in the astonishing range of opportunities it offers to so many Americans. The large number of foreigners who come here to learn testify to this fact.

Yet higher education is troubled. Financial woes arose as a result of inflation during the 1970s, federal and state budget cuts, and a flattening enrollment curve in the 1980s. Colleges and universities are still unable to offer salary-parity with other professions. Much essential maintenance has repeatedly been deferred. Obsolete facilities and equipment hamper teaching and research activities. Research in areas like physics and molecular biology involves costs that would have staggered the imagination just 20 years ago.

Although inflation has been held in check for the past few years, the Higher Education Price Index, which includes a higher labor component and other rapidly raising expenditures, continues to outpace the Consumer Price Index. Consider, for example, the breathtaking rise in the cost of books and periodicals.

Meanwhile, federal funding has declined. Despite Congress' reluctance to cut funds for student financial assistance, total federal aid has dropped 14 percent in constant dollars since 1981. What is more, 60 percent of the 1987-88 federal aid package represented loans to students. Ten years ago, loans made up only 20 percent of the package. Many thoughtful people worry that, instead of investing in our children's education we are creating a new debtor class.

For their part, colleges and universities are spending more of their own money on student aid--a 60-percent increase in the last 5 years. Where is that money coming from? A significant part derives from the ongoing six- to eight-percent increases in tuition that have recently been required to balance university budgets.

Furthermore, the nation is now demanding reforms in higher education. Institution after institution is revising the basic curriculum, tightening requirements, reviewing faculty performance, and seeking ways to help less well prepared students from the high schools obtain the fundamentals they need to benefit from a college education. Professors and college presidents recognize that, if they cannot improve the situation and at the same time rein in constantly rising costs, someone else might well do it for them. And that, they fear, could well jeopardize a 350-year-old American tradition of academic freedom.

While critical of the failings of the academy, most businesspeople understand the importance of preserving its independence. After all, boards of trustees have a heavy representation of businessmen and women who are leaders in their communities and in the nation. Such individuals help maintain the integrity of the enterprise and encourage continuing corporate involvement.

In 1952, corporate giving to colleges and universities amounted to approximately $40 million. Although such contributions were not a major corporate concern, a few business leaders--notably the chairmen of General Motors, Standard Oil company of New Jersey (Exxon) and U.S. Steel (USX)--anticipated the impending explosion in college enrollments. And they feared that American higher education was largely unprepared for increases of this magnitude.

These businessmen believed that, if the colleges were to maintain their independence, they would need a substantial infusion of new resources from the private sector to moderate the inevitable surge of public funds. Citizens in general--and corporations in particular--would have to give consistently and generously to American colleges and universities. Acting on this insight, they founded CFAE--then the Council for Financial Aid to Education and now, more simply, the Council for Aid to Education.

Things began to happen. Company matching of employees' gifts to colleges became commonplace. Existing company-sponsored scholarship programs were expanded, and new ones were launched. CFAE introduced national advertising campaigns in consumer and business media urging everyone to "give to the college of your choice." At the same time, colleges (particularly private institutions) began to expand their fund-raising programs.

CFAE's founders encouraged corporations to make unrestricted gifts to American colleges and universities as a means of providing broad-based and ongoing support. They were concerned with the long-term benefit to society rather than with any immediate business interest. And they assumed that corporate giving would go primarily to independent colleges--assuming that state government would support the publicly controlled institutions.

Ten years later, in the early 1960s, corporate giving to higher education had tripled, reaching the level of $150 million annually. By 1972 it had become $300 million a year. Fifteen years later it stood at $1.8 billion. Since 1955 corporate giving to higher education has increased 28-fold.

As a share of corporate contributions to all causes--including health, the arts, and human services--aid to education has held remarkably stable in recent years at just over 40 percent, although different industries have allocated their contributions in different ways. With their appetite for engineers and scientists, industrial concerns often give more than 50 percent of their charitable contributions to higher education. Banks, retailers and other service-providers generally fall in the 25-percent range.

One of the most striking aspects of corporate giving in the 1980s has been the breaking of historical precedent, in the sense that contributions have risen while profits were declining. Although profits started falling in 1979 and still have not returned to that year's level in constant dollars, corporate giving has surged, in part as the result of company foundations, which tend to minimize the effects of profit fluctuations and to maintain contributions at a relatively constant level. As profits have lagged, the percentage of pretax net income given to education has increased. In 1986, it reached a record 0.88 percent.

Also important in this regard is the new national emphasis on "private sector initiatives" and calls to action by business groups such as the National Association of Manufacturers, the Committee for Economic Development, the Business Roundtable, and others. In addition, the management of corporate giving has become increasingly professionalized. Large companies with million-dollar educational support budgets now apply investment criteria to the awarding of grants. Working toward well defined objectives involving recruiting as well as research and community educational needs, managers charged with contributions administration review requests and recommend grants on a more or less competitive basis. Their recommendations are not always followed by higher management, but the process is far more rational than it was in the days when giving was largely a reactive response to customer pressure or to the personal loyalties of corporate managers, board members, and chief executive officers.

Increased management attention to contributions has had two results, both of which tend to skew the pattern of corporate aid to higher education: First, support is now more focused on direct corporate interests--a business school, for example, or an engineering department at a particular university. At the same time, the share of corporate contributions to the general needs of the college has dwindled. Focused support is needed, and many business leaders argue that it reflects the proper corporate stance in light of the fact that individuals, alumni, and friends have traditionally provided the unrestricted funds. Nevertheless, most college presidents and a large number of corporate contributions managers believe that companies should make more unrestricted help available to help strengthen the liberal arts and the basic sciences--the core undergraduate curricula upon which the quality of specialized graduate training and research ultimately depends.

Second, corporate support has become increasingly concentrated at the major research universities. In 1987-88, 77 percent of all corporate gifts went to 183 Ph.D.-granting institutions; and according to the latest CFAE survey, 25 universities received one-third of the total amount given. The recipients of these contributions include public as well as private universities. In fact, last year for the first time in history public universities received more corporate gifts than the privates.

Meanwhile, the share of corporate support given to liberal arts colleges continues to shrink. In 1987-88, it was seven percent of the total. Furthermore, the nation's community and junior colleges now enroll 40 percent of all students involved in post-secondary education. These institutions are deeply engaged in training and retraining the work force of American industry, but they received barely one percent of corporate gifts to higher education.

After six years of double-digit increases, the growth rate of corporate giving has begun to decline. In 1987-88, corporate support for education rose 2 percent after a spectacular 86-percent rise over the previous five years. It has become apparent that business giving may have peaked, at least temporarily. There are reasons for this development. Mergers, acquisitions, and the drastic restructuring of many major corporations are adversely affecting corporate contributions to higher education, particularly among the largest donors.

Given the nature of the nation's competitive challenge and the role higher education must play in meeting it, business will be well served in the long-run if it can find new ways to support American colleges and universities. At present the 50 largest corporate donors provide 26 percent of the total amount given to higher education. Many small companies give generously, often contributing a larger share of their profits than do larger, more well known firms. But other companies, large and small, owe it to themselves to develop a consistent structured program of giving that would benefit them as much as it does the community. After all, in the "knowledge society," education is the single most important capital investment that any company can make.

Dynamic Alliances Between Business and Higher Education

Andrew I. Wolf

The late Baseball Commissioner and Yale University President Bart Giamatti, during moments of "human foolishness and stress," would summon from the poet Vergil the following adage: "Forsan et haec olim meminisse juvabit"--"Perhaps, someday, even this distress will be a joy to recall." No truer words apply to the contemplation of the "university of the future" by the educators, corporate leaders and government policymakers who have written for this volume, and no truer words apply to the concerns many of us have for the primacy of the liberal arts and sciences in a sensitive, enlightened, democratic, and thoughtful society.

The current mood of the nation is one of confusion, tension and, sad to say, pessimism. Infrastructural, economic, and spiritual conundrums prevail; unrealistic expectations are placed upon higher education and the post-war research-oriented academy to remedy society's ills without adequate resources. In the present national climate, educators, corporate planners, government and foundation policymakers, and human-resources professionals are beginning to undertake an intensive and strategic review of higher education. Many are concerned that the undergraduate experience has become somewhat vague and vocationally oriented. Supported by the Corporate Council on the Liberal Arts and other advocacy/research organizations, they are reaffirming the idea that a solid background in the arts and sciences (complemented by a strong quantitative orientation) constitutes the best preparation of young men and women for successful careers in the business world. A high-quality liberal education is essential for the well-being of individual students as well as for the society at large. The notion of *dynamic alliances* between the academy and the corporate sector is not new. Each year there is an almost ritual-like dance between corporations and educational institutions. Each professes loyalty, admiration, and support for the other. Corporations provide financial support and recruit new employees, while the universities seek sponsorship for their research facilities and support for their other activities.

How do the liberal arts fit into this picture, and why should corporate America be particularly concerned about them? Several years ago the National Endowment for the Humanities published a critical appraisal of the failure of the country's educational system.[1] The basic thrust of *A Nation at Risk* has been further elaborated by writers like Hirsch and Bloom, and the popularity of their books suggest that they have struck a responsive chord in the American public.[2]

Against this background of widespread concern about the efficacy of higher education in the United States, CBS and 13 other major corporations founded the Corporate Council in 1985 to assess the relationship between the liberal arts and the world of work. The Council is affiliated with the Center for Advanced Study in Education at the Graduate Center of the City University of New York. Part of its mission involves the gathering of reliable data about the state of liberal learning in America. Ours is a nation with complex and intricate sets of expectations regarding the calculus of an efficient system of higher education. With 12.5 million students enrolled in more than 3,000 colleges and universities, higher education in America has indeed become the envy of the world.

To be sure, there is waste, duplication, and excessive rigidity in this system, and there is an absence of consensus among members of the academy and policymakers in the government. Expenditures alone will not redress this situation. The challenge, however, is clear: a highly complex, sophisticated and technically oriented world order requires what Harvard President Derek Bok has called a reaffirmation of the partnership that higher education must have with both the federal government and the private sector.

Yet there are problems--problems that have specific implications for higher education, for America's status and position in the world economic order, and for domestic productivity. Consider the following facts and what they tell us about the American educational system:

1) Thirteen percent of the nation's workforce is illiterate. More than 23 million adults in the United States have basic skills at the fourth-grade level.
2) Illiteracy costs the United States about $225 billion annually in lost industrial productivity, unrealized tax revenues, welfare and unemployment payments, and the cost of crime and prisons.
3) Today, 40 percent of Black children are raised in fatherless homes; 43 percent grow up in poverty, and many soon find solace in the streets.

4) As for Black men of college age, it is reported that more are in prison than in school. Another staggering report suggests that more money is spent on drugs in the District of Columbia, this nation's capital city, than is spent on food.

A renewal of our collective belief in the lessons and cognitive processes imparted by a liberal education is clearly needed, particularly as the financial burden of acquiring a college education increases. But although confronted with enormous debt, students and parents continue to enroll in specialized and vocational courses, which they regard as the best preparation for obtaining jobs in the future.

Today one of every four undergraduate students takes a degree in some business-related program. This represents a 257-percent increase since 1966. Once acknowledged as the hallmark of an educated citizenry, the arts and sciences are no longer routinely accepted as the essential core of undergraduate educations. Between 1970 and 1983 the number of bachelor's degrees awarded annually in this country increased by 22 percent; however, the numbers of graduates in the humanities plummeted--in philosophy by 32 percent, in modern languages by 52 percent, in mathematics by 55 percent, in English by 57 percent, and in history by 63 percent.[3] The decline is general. Even the once popular natural sciences no longer attract so many students as they formerly did.

At many institutions, the arts and sciences have been reduced to service courses that support specialized, vocational training programs. Offerings beyond the introductory level have, in many cases, been eliminated. The Council has received letters from faculty members who are deeply concerned about such trends. For example, one history professor from a small church-related college in Tuscaloosa, Alabama, wrote:

> During the past several years, we have experienced a significant decline in the number of students who major in history. In an effort to ascertain the cause of the decline, we asked a sizable number of students the basis on which they decided on a major. They told us their selection was based on the fields they believe would provide the best job opportunities after graduation. A few mentioned history, but most consider business and computer science as their best hope for employment. They are more concerned about employment opportunities the various disciplines provide, than the philosophy, principles, ideas, history, etc. of the major subjects of the curriculum.
>
> The student's failure to understand and appreciate the objectives of the liberal arts curriculum ultimately could

> become a devastating blow to the progress of western civilization. This pervasive mentality of "vocationalism" on the part of today's undergraduates threatens the vitality and purpose of the liberal arts programs. Something must be done expeditiously to move the arts and sciences back to their rightful place in the ascendancy of the curricula of institutions of higher education.

The concerns expressed by this professor are real ones, and they must be taken into consideration during any serious discussion about the future of higher education in America. The Bureau of Labor Statistics predicts that, in the coming decade, the availability of educated workers will exceed demand by an average of about 300,000 annually. Peter Drucker even warns that finding jobs for college graduates will become "the central employment problem in the United States in the next twenty years" because there will simply not be enough jobs suitable to the education they will have received. On the other end of the spectrum, nearly one-quarter of America's teenagers drop out of school, sending more than a million untrained youngsters into the job market every year.

Why should these trends concern business? Is there any connection between them and the need for liberal education? The simple fact is that the products of our educational system will be increasingly absorbed by American business, and its performance will largely depend on the quality of their education. The National Alliance of Business recently published a compelling study of unemployment, underemployment and worker displacement in the United States by the year 2000. This study makes clear that the next 10 to 15 years are crucial if we are to cope with the serious challenges that face us as a nation. Action on the part of all sectors in the economy will be necessary. During the next decade companies will increasingly discover that employees' basic skill deficiencies (reading, writing, speaking/listening, math, and analytical reasoning) will add to their costs, not only through greater remediation expenses but also through lower productivity, greater expenditures of supervisory time, and inferior product quality. Computer skills, have been heralded as a necessity for corporate employees of the future, but such skills will, in actuality, comprise only a small part of what is required of them. Basic academic skills like problem solving and interpersonal communication techniques will be even more important than they are now.

Within this context, we can pose the crucial question in relatively simple terms: should we train the future employees of America's corporate community in a narrowly defined vocational or professional sense, or do we educate them in the time-honored perspective of the humanities, the sciences, and the arts? Should students be trained in technical courses to perform specific jobs as adults? Or should they be educated at the undergraduate level in liberal arts to prepare them for life as well as for a future career?

The Corporate Council has undertaken the task of responding to these questions by seeking to obtain a better understanding of the relationship between education and effective management or leadership in the corporate world. In an increasingly competitive, globally oriented, and technologically innovative society, the Council proposes to examine the premise that the qualities necessary for leadership in the business world include, first and foremost, the breadth and insight provided by a liberal education.

A better understanding of the relationship between these qualities and success in business should prove enormously useful to corporate leaders who coordinate recruitment, in-service training, and the educational policies of their firms. It could also aid university faculty members and staff as they rethink required curricula, counsel students, communicate with parents, and seek to establish mutually beneficial links with corporate America. The Council's goal reflects an insight that the philosopher Alfred North Whitehead had long ago when he contended that "there can be no adequate technical education which is not liberal, and no liberal education which is not technical. That is, no education which does not impart both technique and intellectual vision." The humanities are central to this vision, as Richard Franke, Chairman of the Board of the John Nuveen Company, recently pointed out. "The humanities transport us beyond our own time and place" he said, "but they also anchor us in our society and civilization. They are our patrimony as human beings and our guarantee to the generations that follow us. They bring perspective to our public life and are the crucible where new ideas are tested and traditions challenged. Humanities are concerned with the ultimate questions of meaning, good and evil, right and wrong, language and self-understanding." The development of such perspectives is important for the future of American business and its competitiveness in the world economy, and the university of the future will have a major responsibility for making it accessible to them.

By critically examining higher education and its relationship to enlightened business leadership, the Council hopes to effect a policy model whereby a liberal education will be viewed as the principal instrument for a way of thinking about a larger world and about the essence of what human possibility, human personality, and human competence might ideally become within the existing social order. This model could then serve as the basis for the sorts of dynamic alliances that will enable universities and corporations to work together to assure the necessary support for liberal education, to provide quality leadership for corporate America, and to facilitate the movement of individual graduates into fulfilling and productive careers.

Notes

[1] National Commission on Excellence in Education, *A Nation at Risk: The Imperative for Educational Reform: A Report to the Nation and the Secretary of Education, United States Department of Education* (Washington, D.C.: The Commission, 1983).

[2] E.D. Hirsch, *Cultural Literacy: What Every American Needs to Know* (Boston: Houghton Mifflin, 1987); and Allan Bloom, *The Closing of the American Mind* (New York: Simon & Schuster, 1987).

[3] Joe Johnston, et al., *Educating Managers: Executive Effectiveness through Liberal Learning* (San Fransisco: Jossey-Bass, 1985).

Philanthropic Studies at the University of the Future

Robert Payton

In recent years, a cut across the tree of knowledge would reveal new growth of great diversity: women's studies, Afro-American studies, environmental studies, energy studies, criminal justice, bioengineering, bioethics, and next perhaps, as this essay will propose, philanthropic studies.

The evidence is clear enough: there is the new Mandel Center for Nonprofit Management at Case Western Reserve University in Cleveland. There is the new Center for Philanthropy and Voluntarism at Duke University. There is the new Center for the Study of Philanthropy at the Graduate Center of City University of New York. There are new centers for nonprofit management at the State University of New York at Stony Brook and at the University of San Francisco. Slightly more than a decade ago, a research center was established at Yale as the Program on Non-Profit Organizations. In 1987, Indiana University announced that it was establishing a "comprehensive national Center on Philanthropy," with academic, research, and public service divisions. Other centers are under active study and development; a center focusing on voluntarism and public service, for example, and another that will emphasize fund raising. In addition, there are many degree programs in arts management and museum management and related professional and vocational studies. One could reasonably estimate that there will be a dozen centers or institutes of philanthropic studies by the year 2000, 100 degree programs in philanthropy and in cognate fields of professional study, and perhaps 1,000 or more full-time academic appointments devoted to teaching about philanthropy.

Why all the fuss?

The proximate cause of the surge of interest in philanthropic studies, and the overwhelming emphasis at the moment, is belated recognition of the nonprofit, independent sector as a vast employment opportunity. In a telling statistical comparison, someone has pointed out that the independent sector now employs more people full-time than do the federal and state governments combined. The nonprofit sector's 7 million employees are amplified by the full-time equivalent of 4 million more jobs in the form of volunteers, 93 million of whom need to be trained and managed and supported by the more than 900,000 tax-exempt "charitable" organizations that make up the sector.

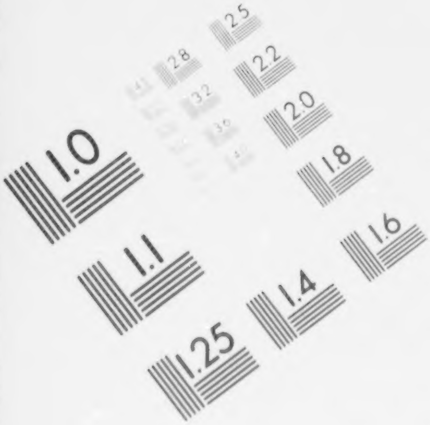
From the days of the land-grant colleges and Joseph Wharton's insistence on "practical education," American universities have responded to educational demand. As Clark Kerr remarked in *The Uses of the University*, the Godkin Lectures at Harvard in 1965, the major changes in American higher education have always tended to come from outside rather than from within the university.[1]

Hundreds of thousands of practitioners employed by nonprofit organizations enroll in training programs offered by for-profit as well as not-for-profit organizations. The practitioners themselves are members of aspiring professional organization; in higher education the organization most directly concerned with philanthropy is the Council for Advancement and Support of Education. The associations provide extensive training programs for their members and often for interested volunteers and other outsiders as well. Instruction in the associations deals primarily--often exclusively--with what are referred to as "the nuts and bolts" of fund-raising, public relations, publications, recruitment and management of volunteers, and an array of daunting legal and technical questions of estate planning, tax exemption and deduction, postal regulations, direct mail, computer software systems for gift acknowledgement, and so on.

Unlike colleges and universities which have a broad base of income and tend to be stable and relatively permanent, many other nonprofit organizations are the product of single-minded commitment of a person or group captured by an idea. The Mothers Against Drunk Driving, Covenant House, Moral Majority, and tens of thousands of other organizations face similar problems. As they gradually become stabilized, the survivors face different problems--organizational development, permanent facilities, financial management. Although there is a move upward toward more sophisticated and longer-term study, the emphasis remains technical, practical, and applied.

The new movement, however, reaches beyond vocational and technical training and asserts an interest in more formal education. There is a rush toward professional programs; there is a tentative exploration of the place of philanthropy in the liberal arts. But it is the latter that offers a much more interesting insight into the management of the House of Intellect.

It is a working assumption of this essay, subject to plausible challenge, that the arts and sciences are the core of the university. The familiar structural image of a core of disciplines which are drawn upon by diverse



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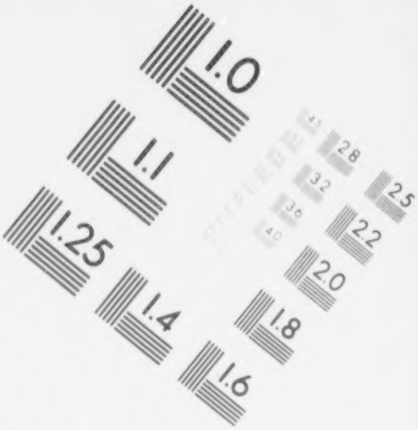

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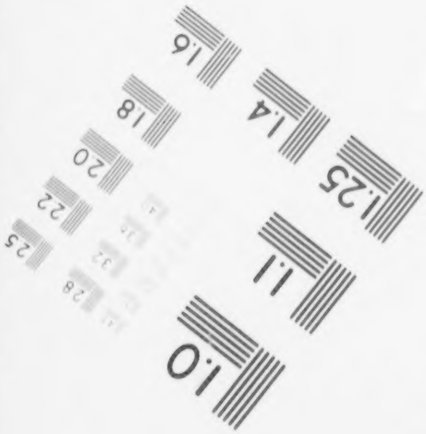

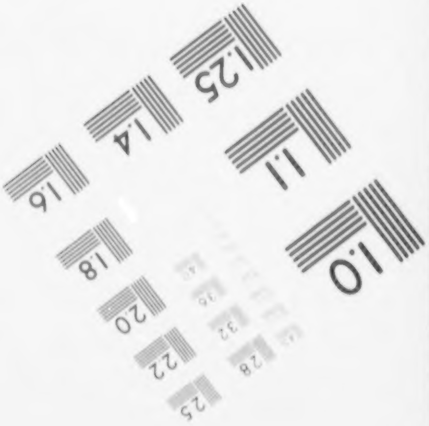

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professions is widely accepted. It is possible to have a university without a law school or a school of business or a school of social work; it is not possible to have a university without mathematics, history, chemistry, or (allowing for changes of labels) sociology, philosophy, or economics. For philanthropic studies to make a claim to a place in the liberal arts, a place among the humanities and social sciences--that would be a bolder claim by far.

Thus far, there is no such thing as "philanthropic studies" in the university. What is underway at the moment is a largely externally inspired cluster of new undergraduate courses, the product of a competition sponsored by the Association of American Colleges on the initiative of the American Association of Fund Raising Counsel and funded by the AAFRC Trust for Philanthropy and several foundations and corporations. Between 25 and 30 new courses will be introduced over a 3-year period. Another 100 courses or so may (by my intuitive and undocumented estimate) be offered as courses in philanthropy out of the initiative of individual faculty members. Were one to include all of the cognate courses bearing names like "Social Justice and Individual Responsibility," the number would be 10 times as large. (These numbers might be compared with the several thousand courses offered in women's studies.)

There are no undergraduate degree programs in philanthropic studies in the liberal arts. Rhodes College in Memphis recently persuaded a benefactor to provide funds for a chair in philanthropy. The new programs at Indiana and Duke will soon offer courses jointly sponsored with other departments and schools. Special courses will be offered on an experimental basis in departments of economics, political science, history, philosophy, religion, anthropology, sociology, and American studies. The courses will approach the subject from the vantage point of voluntary action in some cases, and in others from the perspective of social change. Still others will attempt to fit philanthropic action into subjects that have in the past given it little or no attention (economics, for example).

This show of energy and activity, however, obscures a large number of interesting and difficult questions. They are questions that will emerge implicitly if not explicitly in faculty discussions and debates about course offerings, about what will be taught, who will teach it (under whose aegis and with which qualifications), and where the subject will find its place among the disciplines.

"Philanthropic studies" is not being put forward as a discipline, whatever the claims to residence in the exclusive neighborhood of the liberal arts. Philanthropic studies is a theme or a topic, akin to women's studies or urban studies. It can be studied separately only from an interdisciplinary approach. Philanthropy can also emerge within the framework of other interdisciplinary studies (as with American studies or women's studies) or within the framework of the individual disciplines (as in the history of philanthropy or the economics of philanthropy). Philanthropic behavior as a manifestation of altruism, for example, can be dealt with by philosophers, psychologists, and sociobiologists, among others. Philanthropic studies could thus become a useful focal point for efforts to compare and integrate (if such be possible) diverse insights into altruistic behavior.

The first question is not simply the territorial one but also the difficult problem of what "philanthropic studies" is about. It cannot be assumed that we know enough about the content of philanthropic studies as yet to know whether it should be a subject standing apart but attached to the liberal arts, or whether it should grow up inside of the departments, competing for space and sustenance along with other interlopers.

Reflection at the abstract level of the organization of knowledge presents one set of issues; reflection at the more mundane level of organization of knowledge *within the university* raises more urgent matters of budgets, personnel, space, tenure tracks, and other harsh and unpleasant realities. The future of philanthropic studies as a part of the liberal education of undergraduates is unlikely to emerge without substantial funding from external sources.

A second important source of support is the importance of private philanthropy to the institutions of higher education. Whether public or private, colleges and universities seek gifts and grants from private sources. Many institutions (especially the well established residential campuses) begin early in the undergraduate experience to socialize students into something which might be called "alumni-hood." Raising consciousness about the importance of private contributions is a preoccupation, and many presidents and trustees would welcome the arrival of philanthropic studies as a sign of educational encouragement to an important institutional practice.

Mainstream American values have always given a high place to voluntary service. American colleges teach that each of us has a responsibility to make a voluntary contribution to improving the welfare of the community, to join in the tradition. Even without philanthropic studies as such, American students have been called upon at various times to join in the effort to abolish slavery, improve prison conditions, protect children, conserve natural resources, improve the circumstances of minorities, advance civil and human rights, or work for world peace.

The history of the idea of philanthropy may be thought of as "the social history of the moral imagination," as voluntary efforts to reform, improve, ameliorate, enhance, or strengthen the commonweal. To teach philanthropic studies is often cast in such a mold: philanthropic studies is not disinterested; philanthropic studies is normative. Philanthropic studies, some will argue, will give us a context in which to teach about leadership, citizenship, community, and service. Some others will contend that that amounts to indoctrination into an ideology, the very antithesis to what a university education should be about.

Is philanthropy an American ideology? Do philanthropic values so permeate our thinking that we cannot detach ourselves enough to look critically at the idea? Are the people who would teach philanthropy so committed to advancing the tradition that one should be skeptical of their ability to be objective?

The most serious substantive charge against the place of philanthropic studies in the university is just that, argued from perspectives that are politically of the Right as well as of the Left. Jacques Barzun, for example, in *The House of Intellect*, labeled philanthropy as one of the three enemies of Intellect.[2] Philanthropy, in his view, brings an uncritical compassion into the university, compromising the integrity of thought and discourse. Philanthropy is seen as the willing ally and even sponsor of anti-intellectual psychologies. In addition to being a worldview, Barzun viewed philanthropy primarily in its foundation form. The degree to which philanthropy is equated with philanthropic foundations appears to determine whether judgments of philanthropy as an instrument of social action will be based on the uneven performance of professional grantmakers.

In a comparison of British and German universities in 1868, Matthew Arnold found much to praise in the German and little to praise in the English. He praised the German universities for their commitment to science. The only thing worthy of admiration he could point to in the British universities was their endowments. British intellectually lethargy might one day be overcome, Arnold wrote, and when "the love of the things of the mind awakens amongst us, our endowments will be invaluable, and their worth will be deeply felt by us."

In 1930, after teaching in America for four years, Harold Laski observed that universities are seduced by the great wealth which foundations can bestow upon them. The content of academic programs is determined by executive anticipation of what it is that will attract the most generous foundation support. No strings are attached to foundation support, Laski said, because no strings are necessary. University presidents seek success through fund-raising, and foundation presidents are stuffed egos in search of admiration, beguiled by flattery into believing that their ideas are entirely worthy of a central place in the university's programs. Thirty years later Barzun repeated the same judgments.

Philanthropy, then, may be seen as a corrupter of university morals. University presidents--entrepreneurs and opportunists--are chosen for their ability to exploit the vanity of foundation executives. Behind the presidents are university trustees, important and wealthy businessmen (of the kind pilloried by Thorstein Veblen) who use their philanthropic influence to bring alien values into the world of scholarship.

The argument against being able to deal with philanthropy within the university is cast in terms of the university's own narrow self-interest. Philanthropic studies will be uncritical because the university cannot afford to be the haven for critics of foundations and individual philanthropists. The university needs the funds that it seeks from foundation and corporations and alumni and others, and it cannot tolerate serious attacks on them or on the system which encourages them to contribute. We are likely to be blind to the weaknesses and deficiencies of philanthropic practice--either blind by virtue of false consciousness or blind by self-interested preference.

Many interdisciplinary programs suffer from the same criticism. Women's studies, for example, is often accused of being as much devoted to advocacy of a particular intellectual perspective as it has been a disinterested study of the place of women in society. What one philosopher might deplore as undermining the integrity of "the core value of cognitive discourse" in the university, another might praise as using the university to overcome oppression. Philanthropic studies clearly encompasses the work of activist organizations of all shapes and descriptions; but are studies of philanthropy themselves a form of advocacy? Is philanthropic studies merely another effort to perpetuate the status quo? Or is it another means of using the university as a weapon in the service of a higher cause?

The enthusiastic sponsors of philanthropic studies are committed to private voluntary action for public purposes. They are devoted to the tradition, worried about its survival during a period of changing social values, and determined that it will not dwindle into insignificance.

If some proponents of philanthropic studies hope to encourage student voluntary service and social activism, some others see in philanthropic studies the promise of a new stimulus to the humanities and social sciences, a new opportunity to attract student interest. Every prospective new field represents a career opportunity for some people (while it is a threat, usually obscure and indirect, to others). Should philanthropic studies become popular, campus-based philanthropic organizations will recover much of the relevance lost in recent years. Many religious organizations design their activities around voluntary community service for the elderly, the poor, and the disabled. Religion takes on practical importance and meaning to student volunteers working at day care centers, senior citizen centers, or in soup kitchens. Students who may have managed to escape the impact of religion while growing up in secular homes and attending public schools may meet it head-on if the study of philanthropy leads them into personal service to others. There are few voices willing to speak against such service, and a rising chorus encouraging and applauding it.

Sustaining philanthropic values while thinking critically about the underside of philanthropy is difficult. Many of the same tensions arise for people attracted to careers in philanthropic work. When confronted with the ethically ambiguous techniques of fund-raising and the cultivation of professionally profitable friendships, many become discouraged and disillusioned.

An important consideration relating to the emergence of philanthropic studies is whether advocacy and scholarship can coexist. If philanthropic studies follow the path of the professions, they will be more concerned with practice than with theory. Their weakness will appear in failures of self-criticism. On the other hand, should philanthropic studies find their home in the liberal arts, self-examination may undermine a concern for practical goals.

Another aspect of philanthropic studies that will force itself into the discussions at an early stage is that of the qualifications of those who will teach the subject. Philanthropy is a world of action rather than one of reflection: as has been suggested here, concern for action is more characteristic of professional studies while concern for theory is more characteristic of liberal studies. Many educators have sought to bring the study of business, law, and medicine into the undergraduate, nonprofessional world of liberal studies, trying to build practice on a more secure theoretical foundation.

Philanthropic discourse is usually conducted as a form of persuasion. But if one proposes the study of philanthropy, the call is upon the values of science, the rigors of logic rather than those of rhetoric. Philanthropic studies in the university places them under examination to find their theoretical underpinnings: that is why philanthropic studies must draw on the insights of the humanistic and social scientific disciplines. To study philanthropy in the university is to bring practice together with theory--or at least to contend that it can be done.

Practitioners are more welcome in professional schools than they are in the disciplines. The credentials of scholars in economics and anthropology and literature are not those of the financier, the social worker, or the poet. What kinds of credentials are appropriate to those who would teach and study philanthropy?

Some of the new university centers of philanthropic studies are determined to mix scholars and practitioners in their programs. Some of the others seem to be approaching the subject with a preference for certified academics, with Ph.D.s in established disciplines. The academic culture is inhospitable to intruders and their agents. Neither the subject nor its teachers are likely to be admitted without traditional credentials.

The readers of this essay on the occasion of its first appearance will have an opportunity to observe the problematic process sketched out above. The field may emerge stillborn; it may simply move toward making itself another of the so-called minor professions, an appendage of social work or a subfield of public or private management. The field may be unified at the undergraduate level but fragmented into highly technical studies in various graduate and professional schools. It may simply be absorbed within the disciplines, as economics and psychology and philosophy decide that it is more prudent for them to co-opt the philanthropic initiative than see it become another rival for attention.

I am on record in many places as an advocate of philanthropy as a tradition worth preserving in American society; I am also professionally engaged as a student and teacher of philanthropy. I proceed on the assumption that it is possible to do both, and that philanthropic studies as a field can achieve that same balance. On the basis of my experience in higher education, I confess to some doubts about a field that sets out to blend theory and practice, scholars and practitioners, tradition and criticism, advocacy, and reflection.

Even so, the effort seems worth it.

Notes

[1] Clark Kerr. *The Uses of the University* (Cambridge, MA: Harvard University Press, 1963).

[2] Jacques Barzun, *The House of Intellect* (New York: Harper and Brothers, Publishers, 1959).

The University and the Black Athlete

Harry Edwards

I begin with three fundamental propositions. The first is what I term the first law of sports sociology: sport inevitably recapitulates the structure and dynamics of human and institutional relationships in society as well as the ideological sentiments that rationalize those relationships. The second is a proposition that W.E.B. DuBois outlined several generations ago when he declared that the problem of the twentieth century is the problem of the color line. The third is something I consider to be a universal truth in America: when anything of a systematically negative character happens in this nominally integrated country, it happens to the subordinate minorities first and worst. These propositions suggest that the problems we see in sport are deeply rooted in and perpetuated by problems with which we have failed to cope successfully in society at large. It is futile to attempt to clean up the mess in sport without seriously addressing the broader social and racial problems that it reflects. If we are going to attempt to mop the floor, we must first turn off the faucet.

When we speak of collegiate sports, we are talking principally about basketball and football at the Division 1 level. We are not talking about badminton or field hockey, golf, tennis, diving, gymnastics, swimming, or any of the minor sports. And when we speak of Division 1 basketball and football, we are speaking about the impact of the Black athlete. The demographics of the situation are unequivocal. Within the next seven to ten years, Division 1 basketball and football will be entirely Black for all intents and purposes. Owing to the magnitude of this Black involvement, the major controversies in collegiate athletics will increasingly be rooted in America's unresolved racial problems and in the intense commercialization of sport that has emerged since the early 1960s in the wake of lucrative television contracts.

In order to understand the dynamics of this situation we must understand something of the history of race and power in American society, where social divisions have been artifically created and sustained through an institutionalized system of racial prejudice and discrimination. Institutionalized racism in America is particularly acute in the occupational sphere, where it is rationalized by allegations of cultural, behavioral, and intellectual inferiority based upon racial characteristics. As the recently fired baseball executive Al Campanis would say, Blacks "lack the necessities" to assume responsible managerial positions in sport. The presumption of inferiority is a core concept in the institutional implementation of racism, but its goal is to maintain economic and social power for the dominant group in society while it relegates minorities to subordinate labor roles. As America's largest racial minority, Blacks have traditionally been concentrated in certain economic roles while being virtually excluded from others. The greater the power, privilege, and authority associated with a particular role, the less likely it is to be occupied by a Black.

Both government and private corporations have been guilty of excluding Blacks from power and authority. In 1984, for example, Blacks held less than 3 percent of the highest level (GS 16-18) positions in the federal government. Blacks have also been particularly disadvantaged in occupations requiring professional certification. This situation has arisen not so much as the result of direct occupational discrimination as through the impact of traditions that restrict Black access to the means of credentialization. For example, of approximately 650,000 lawyers in the United States in 1984, less than 1 percent were Black. And the number of Black lawyers is declining because fewer Blacks are applying to law school. Of 435,555 physicians in the country, only 13,243 (or 3.1 percent) are Black. Of the 125,291 dentists in the country, only 2.5 percent are Black. Of the 145,000 pharmacists, only 4,715 (or 3.2 percent) are Black. Only about one percent of America's engineers and chemists are Black. No more than four percent of its college professors are Black, and the overwhelming majority of those professors are in traditionally Black schools or in Afro-American studies departments on traditionally White campuses; we have essentially established Bantustans for Black college professors both within traditionally White institutions and at Black institutions. In corporate America, similar patterns of racial division exist. The July 9, 1984 *Wall Street Journal* reported a survey of some 1,300 senior corporate executives; only 3 of them were Black. An even broader study by the national Urban League indicated that 1 of 13,000 high-level corporate managers, only 117, or less than 1 per cent, were Black. Furthermore, according to both the national urban league and *Black Enterprise Magazine*, Black representation in such positions is deteriorating precipitously.

American sport inevitably recapitulates the social relationships suggested by these statistics. Thus, Blacks in the United States are virtually excluded from most sports. Forty years after Jackie Robinson supposedly shattered the color line, more than 90 percent of American sports remains almost entirely White. For the sports in which they do participate, Blacks are concentrated in the most exploitable, least powerful, and most expendable roles (i.e., as athletes), while they are virtually excluded from positions of authority. In Division 1A universities, Blacks are woefully underrepresented in such positions. There is only one Black athletic director at a Division 1A university--Charles Harris formerly at the University of Pennsylvania and presently at Arizona State University. There is only one Black head baseball coach in a Division 1A institution--Dave Baker at Kansas State. Among 282 colleges and universities classified as Division 1 by the NCAA in basketball, there were only 29 Black head coaches as of 1986, if one discounts the 16 Black institutions in this category. Of 105 NCAA Division 1 schools in football, only three had Black head coaches as of fall of 1987--Bryant at Ohio University, Peay at Northwestern, and Nunley at the University of Nevada-Las Vegas. These figures must be understood against the background of the fact that 25 percent of all basketball and football head coaches at Division 1 schools resign or are fired each year. In 1986-87 alone, 68 head basketball coaches left their jobs at the end of the season. At the end of the football season, 27 head football coaches were replaced. Yet we have only 3 Black head football coaches and only 29 Black head basketball coaches.

However, 55 percent of Division 1 basketball scholarships nationwide go to Blacks. More than 80 percent of the starting players at the top 20 institutions were Black at the end of the 1986-87 season. In some conferences, the percentage of basketball scholarships awarded to Blacks runs as high as 70 percent. Approximately 50 percent of all Division 1 football scholarships go to Blacks, and some conferences have even greater proportions of Blacks on scholarship; for example, in 1986 Southeastern Conference schools, which include Mississippi, Georgia, and Alabama, awarded 68 percent of their football scholarships to Black athletes. To place this statistic in perspective, we must remember that less than two percent of the student body at these schools and less than one percent of the faculty are Black.

The roles played by Blacks in sport clearly mirror those played by Blacks in the society at large. Blacks for the most part have access only to those sports in which their skills and talents are exploitable financially (i.e., revenue-producing sports like football and basketball) and to those sports in which their skills and talents are exploitable politically, (e.g., international track-and-field competition). A significant consequence of occupational discrimination against Blacks is the fact that successive generations of Blacks as well as Whites have been socialized to accept the *status quo*. Among Whites, the existing racial configuration in the occupational hierarchy is often seen as a corroboration of racist expectations relative to Black capabilities; therefore, many Whites perceive the limitation of Blacks' access to high-status positions as perfectly justifiable. Stated in the simplest terms, Blacks are believed to be best suited for menial, usually physical, labor, and least suited for intellectual decision-making roles. By the same token, Blacks' perceptions of their opportunities within the existing occupational structure often reinforce the notion that Black people should limit their aspirations to "realistic" career goals consistent with limited opportunities. In both sport and society, the result has been the perpetuation of what is in effect a plantation system of authority. Whites enjoy a virtual monopoly on power and decision-making roles, while a few token Blacks occupy mid-level junior executive positions--head Negroes in charge of Negro affairs. The vast majority of Blacks are concentrated in lower-echelon, relatively powerless production roles--those of laborers or athletes. Thus, the color line remains firmly established in both American sport and American society.

In the United States, sports and education are structurally intertwined. High school serves as a training ground for college-bound athletes. Colleges serve the same function for professional teams and for America's Olympic contingent, 86 percent of which is drawn from NCAA member institutions. But the image of the athlete has always been somewhat of an anomaly within the educational setting, and this is particularly true for the Black athlete. Like White athletes, Black athletes must contend with the social connotations of the traditional "dumb jock" stereotype. But Black athletes are also burdened with the racist myth of innate Black athletic superiority, a myth that reflects a prevalent White belief according to which Blacks are more animalistic and, by racial heritage, more suited than Whites to physical endeavor. The blatantly racist stereotype of the dumb Negro condemned by his racial heritage to intellectual inferiority also plays a role in the perception of the Black athlete. Under such circumstances, it should come as no surprise that the shameful academic situation of the Black student athlete has not only been tolerated--it has been anticipated, cultivated, and institutionalized. Thus, by the time many Black athletes have completed high school and begun seeking admission to college as a means of pursuing their dream of sports stardom, so little has been demanded of them academically that no one expects anything of them intellectually. They have essentially evolved into one-dimensional people whose lives are almost totally dominated by the obligations of sports participation.

Because Black youth are channeled in disproportionally high numbers into the role of athlete, no major college football or basketball program can hope to be successful without seeking to recruit the outstanding Black athlete. The Black athlete has thus emerged as the backbone of revenue-producing collegiate sports in this nation. In many instances, however, they have practically no academic skills worthy of the name. Once such high-risk Black athletes are enrolled in college, they are kept academically eligible to participate in sports by phony grades and specially tailored courses that cater to their eligibility needs. Low graduation rates for Black athletes have become the norm at major universities across the country; 70 to 75 percent of all Black scholarship athletes never graduate from the colleges they represented in sports. The magnitude of the exploitation of the Black athlete by these colleges is highlighted by the fact that only 1.73 percent of athletes who participate in intercollegiate football or basketball ever make a payday as a professional athlete; furthermore, the careers of 60 percent of those who do make it into the professional ranks are finished within 3 or 4 years. Nevertheless, major American colleges continue to pursue one generation after another of academically deficient but athletically indispensable Black athletes, who are perceived as having no role or legitimacy on college campuses except as sports participants--like twentieth-century gladiators in the service of White-controlled, White-dominated universities.

The drug problem in sports is also rooted in relationships that characterize the society at large. In the United States, we consume more legal and illegal drugs in greater variety than any other people on earth. Each year Americans swallow hundreds of millions of pills and tens of thousands of pints of opiate and chemically laced elixirs attained legally through prescriptions and over-the-counter sales. As a matter of course, many people begin each day with a little caffeine, move the day along with a little nicotine and alcohol, and then rely on a sedative or sleeping pill to block out the day at bedtime. In the guise of the coffee break and the three-martini lunch, we have institutionalized drug use in our work routines. Beyond acceptable and legal pharmaceutical indulgences, the advent of the drug culture in the mid-1960s has led to the annual consumption of literally hundreds of tons of illicit drugs. In fact, although we constitute less than 5 percent of the world's population, Americans consume more than 67 percent of the world's illicit drugs. According to the U.S. Drug Enforcement Agency's conservative estimate, the American public snorted, injected, and smoked just over 150 metric tons of street-grade cocaine in 1986. In that same year, while some member of Congress and representatives from the Department of State were castigating Mexico for failing to control cross-border trafficking in marijuana, U.S. law enforcement authorities eradicated more than twice as many marijuana plants in this country as were produced in the entire Mexican crop. This action still left nearly 2,000 tons of high quality, American-grown marijuana available for sale to an eager domestic market. Along with these 2,000 tons, we imported another 1,500 tons of marijuana from abroad. We did not export a single ounce of grass; we smoked it all up right here. When we further consider the use of amphetamines, heroin, PCP or angel dust, hallucinogens such as LSD, and other widely abused recreational drugs, the inescapable truth emerges: we are a nation so consumed with drug-taking that we have become a truly "high" society. We have traditionally placed athletes on a pedestal, but they remain subject to the same temptations as everyone else. This is especially true of those from the lower echelons of society.

Confronted with intense pressures to win with a limited number of players in an environment of escalating costs and the virtual certainty of injury to competitors, college and professional sports organizations have actually made pharmacology an integral part of their personnel decisions and game plans. The same recruitment and development practices that reduce athletes to one-dimensional production units have also helped create the drug problem in sports. Stated simply, athletic talent, which is the key element in athletic success, is so valued by major universities that they often tolerate serious personal and social problems among athletes. Athletic proficiency is perceived to compensate for a multitude of other deficiencies. An obsession with winning has spawned scandal after scandal in collegiate athletics; it is also responsible for much of the drug-abuse problem in sports. Athletes already involved with drugs are actually being recruited by major universities. Len Bias and Don Rogers were perhaps but the first wave of drug-abuse casualties among athletes who have matured in the shadow of the drug counter-culture.

The worst may be yet to come. Many collegiate sports programs will increasingly be recruiting athletes in revenue-producing sports from Black inner city schools. In the next five to seven years, intercollegiate basketball and football will become overwhelmingly Black in response to the preoccupation with athletic success. In order to comprehend the ramifications of this situation, we must understand developments that are currently taking place at the interface of race, sport, and social change. Big-time college sport is entertainment. It is big business and it is getting bigger. Television provides the money that oils the gears of this athletic machine. With the Rose Bowl paying 11.8 million dollars to the two teams and conferences involved, universities need young men who can streak the length of the field and catch the ball over their shoulders, half-backs who can cut across the green and throw the length of the field. The entertainment value must be there.

The demise of the family farm, hard times in rural America, the dominance of agribusiness, and the deregulation of transportation (meaning that buses, trains, and airplanes no longer fly to many small town) have hastened the exodus of rural white families to the cities and the suburban areas that produce relatively few athletes in the revenue-producing sports. The majority of college and professional athletes in these sports come from the Black inner city, from Black rural areas, and from White rural areas, like the one where Larry Bird grew up. In White suburban areas, parents are far more interested in encouraging their children to become lawyers, doctors, opthamologists, engineers. Only the lower echelons of Black society allow their children to devote the time and energy necessary to develop extraordinary athletic skills by the time they are 17- to 19-years-old. In an environment where freshman eligibility is defended as an economic imperative, academic problems are bound to intensify, especially in light of what is happening to inner city and rural Black schools. As educational expectations continue to decline in Black society, Black athletes at major universities are becoming more and more like "hired guns."

But the problems are not only academic; they also reflect a culture clash of monumental proportions. In the Black community, people live with an entirely different set of assumptions from those operative in White society. The vocabulary is different. Thus, White women's charges of being raped by Black athletes are often the result of breakdowns in communication. Flirting in the Black community is not the same as flirting in the White community. Where they grew up, a young woman walking down the street would not even make eye contact with young men standing on a street corner. She would not communicate any sign of encouragement. When these young men arrive on a university campus, they find themselves in a totally different environment. It is acceptable to flirt. Such behavior never occurs in the Black community because it would mean that the woman is signaling her availability. On campus, however, there are many young women who were raised in the suburbs, where flirting is regarded as a normal mode of social interaction. Conditioned to believe that sex is the reward for athletic prowess, Black athletes interpret this flirting as an invitation for more intimate contact, even when it was not meant that way at all. Such breakdowns in communication between people from different cultural spheres are likely to become more frequent as greater numbers of Black athletes are recruited by major universities throughout the United States.

There are many serious problems in the world of intercollegiate athletics. They all reflect larger societal issues, including the problem of race relations. If universities fail to address these problems that they have inherited from society, the tragic result may well prefigure what is in store for us as a people, because the situation in intercollegiate athletics mirrors the condition of our society; it suggests what we have become as a nation and where we are headed.

Computers and the University of the Future: From Mental Models to Graphic Media

Lynn A. Cooper

There can be no doubt that information-processing devices in the form of digital computers are having a significant and ever increasing impact on society as a whole and on educational institutions in particular. Virtually every issue of *The Chronicle of Higher Education* in the past year contains one or more articles extolling the virtues (or lamenting the disappointments) of computer use in colleges and universities and/or reporting the effects of computer use on various aspects of campus life, ranging from social adjustment to academic efficiency.

Indeed, the introduction of computers and considerations about the nature of such information-processing systems have transformed universities at levels of structure, content, and process. Structural changes include the breakdown of old and the creation of new disciplinary boundaries. Departments of information sciences are now frequently found at major universities, and a funding program at the National Science Foundation is dedicated to this growing area. Interdisciplinary programs in the field of cognitive science are being initiated across the country, and these programs take various forms in different academic contexts--usually including some subset of the traditional disciplines of psychology, philosophy, linguistics, computer science, and engineering, but in some instances incorporating fields like neurology and neuroscience as well.

The content of instruction and of research has been changed, as well, by the widespread use of computers. Most obviously, virtually all scientific disciplines which use computers in research currently require training in both the hardware and the software associated with the commonly employed computer systems. Computer science itself has enjoyed growing popularity both as a major subject in undergraduate education and as a field of graduate study.

At the level of process, the use of computers has profoundly affected both research and educational practice. Laboratories in natural and behavioral sciences are heavily dependent on computer-related technology for the construction of experiments, the collection of data, subsequent analysis, and the graphic presentation of experimental results. And non-experimental research in many fields, from humanities to sciences, has changed in scope and character owing to the accessibility of large data bases of textual information. Unprecedented increases in sheer computing power are allowing the development of statistical and mathematical techniques and the solution of problems that were not possible even in the recent past.

Clearly, then, modern information processing systems are permitting things that have never been done before to be done in university, government, and industrial settings. Along with these advances come certain needs of which universities are becoming aware. The reorientation of laboratory sciences toward computer technology creates a pressing need for skilled technical support to generate software and to maintain hardware without which the daily business of the sciences would not be possible. The introduction of computers into the classroom creates the need for instruction in human-machine interaction for faculty and students alike. And the requirement or strong encouragement of personal computers for undergraduate university students intensifies the economic pressure on individuals who desire higher education.

The major portion of the present discussion is directed toward two of the many considerations that arise from the acknowledged impact of computers and information processing on the university. The first revolves around the way in which computers have revolutionized our conceptions of and our methods for examining the nature of human cognition. The second consists of an examination of some of the possibilities and challenges arising from the use of computer graphics as a medium for the display and transmission of information.

Computers and changing conceptions of human cognition

Perhaps the most far-reaching intellectual consequence of the introduction of digital computers is the idea that such machines could serve as a model for the nature of human thought. Indeed, if there is any single notion on which the field of cognitive science is predicated, it is that the human mind is computational--i.e., a system in which representations or symbols are manipulated according to an explicit, specified sequence of rules in order to obtain a particular outcome. The commitment to such a computational approach is the glue that holds together the diverse disciplines that combine to produce the field of cognitive science. Haugeland provides a clear statement of this basic notion: "Indeed, the guiding inspiration of cognitive science is that, at a suitable level of abstraction, a theory of 'natural' intelligence should have the same basic form as the theories that explain sophisticated computer systems. It is this idea which makes *artificial* intelligence seem not only possible, but also a central and pure form of *psychological* research".[1]

There is tremendous intuitive, practical, and empirical appeal to the suggestion that human thinking is computational. At the intuitive level, processes such as operating on symbolic representations with sequences of rules seem very much like the activities that we engage in consciously when we try to solve difficult problems, reason to conclusions, or learn about subject matters. At the practical level, it is possible to construct computer programs that behave in just this fashion and, thus, provide simulation models that mimic human thinking. Such simulation models often take the form of production systems, in which the rules applied to the representations in the computer program are stated as "condition-action" or "if-then" pairs. At the empirical level, behavioral predictions that can be derived from such simulation models often turn out to correspond well to the ways in which human beings act in well defined laboratory settings. Problems or tasks that should be hard in terms of the number or complexity of operations that must be performed in the computer model are frequently the sorts of situations in which humans also require considerable time or are particularly prone to errors.

The computer-modeling approach based on production systems or the application of condition-action rules has enjoyed considerable success as a tool for understanding a variety of cognitive processes, including complex problem solving and the retrieval of information from memory.[2] These same kinds of rule-oriented approaches form the core of "knowledge-based" or "expert" systems for accomplishing particular specialized tasks and of the multitude of "intelligent" tutoring systems that are being developed or are already in use for instruction in specific subject matters, most commonly in sciences or mathematics.

In addition to the theoretical and practical contributions of rule-based computer models, the symbolic representations-and-rules approach has provided a powerful conceptual framework within which to view the nature of human cognition. This framework characterizes the human mind as a system in which information coming in from the external world is converted into symbolic form, with the symbols being operated on sequentially or transformed by an ordered series of processes beginning with such "low-level" processes as perception and attention, progressing to "higher-level" activities including memory, reasoning, and problem-solving, and eventually decoding the transformed symbolic information into appropriate action.

Yet despite the demonstrable success--both practical and conceptual--of the representations-and-rules approach to artificial and to natural intelligence, there has been grumbling and dissension from both outside and inside the ranks of cognitive scientists. Grumblings from the outside frequently take the form of condemning the "dehumanizing" features of these relentlessly mechanistic models of mind. Where, in the machine metaphor, can the generative, creative, and artistic aspects of human thought and experience be found? How can conceptions of beauty and truth as well as ethical and evaluative judgments be derived from symbolic structures operated on by sequences of rules? How can forms of thinking such as insight and intuition be modeled in these systems?

Dissatisfaction with the symbolic, rule-based approach to understanding human cognition has also recently arisen within the discipline of cognitive science itself, but this internal dissension has somewhat different basis than the criticisms from outside the field. It has been fueled by two central considerations: The first is an appeal to the nature of the cognitive activities at which people seem to be far more proficient than digital computers are, and the second is an appeal to the nature of the architecture of the human brain. Dissenters from the symbol-processing approach point out that certain classes of natural cognitive tasks--such as perceiving objects and events, acquiring certain kinds of skilled performance, and learning to adapt behavior in situationally appropriate ways--are achieved quite easily by people, but are done, if at all, only with great effort by computer systems based on representations and rules. Furthermore, the sequential, symbol-processing systems proposed in artificial intelligence and cognitive science bear no resemblance to what little we know about the structure of the human brain--the actual physical system in which cognitive functioning must ultimately be realized.

The alternative computational framework for modeling mental processes that is being advanced by this group of cognitive scientists, often referred to as "connectionists," is one in which information processing occurs by virtue of the simultaneous interaction of a large number of simple elements. The class of models being proposed is based on parallel distributed processing (hence, referred to as PDP models). The types of situations that such models are designed to handle best are ones in which multiple sources of information must be kept track of simultaneously, with each source of information constraining and, in turn, being constrained by other sources of information. An example that has been discussed extensively by McClelland and Rumelhart is the way in which language is processed in the course of reading a sentence.[3] Sources of information that contribute simultaneously to the understanding of written material include knowledge of syntactic structure, the semantic relations that different constituents of a sentence bear to one another, and even the orthographic properties of the words themselves. Each one of these sources of information provides simultaneous mutual constraints which, together, interact to produce an interpretation of written language. That is, syntactic structure constrains the semantic interpretations placed on the constituents of the sentence, and the semantic interpretation constrains the assigned grammatical role of constituents in sentences like, "I saw the Grand Canyon flying to New York."[4]

Without providing details, suffice it to say that this PDP or connectionist framework for modeling human cognition differs sharply from symbol and rule systems at both theoretical and computational levels. Central to the PDP approach is the idea that the basic work of cognition is done by sets of elementary processing units over which meaningful patterns can be defined. Contrast this with the traditional systems in which single units represent large meaningful entities, such as concepts. The role of each unit in a set is to receive input--in the form of activation or inhibition from its neighboring units--and to compute output values that are in turn sent to the neighboring units. All units carry out computations simultaneously, and the units interact. Specifically, the pattern of connectivity among the units corresponds to what is "represented" in the system or what the system "knows." That is, knowledge is dynamic rather than static in these systems.

Perhaps most relevant for the purposes of the present discussion is the difference between the PDP and the symbol-processing approaches to modeling learning. In representation-and-rule-based systems, learning proceeds by the explicit formulation of rules. There is an underlying assumption that the goal of learning is the construction of powerful, general rules (often in the form of productions). Rules are generated by beginning with some knowledge about a domain to be learned and then by formulating hypothetical general rules, perhaps by comparing particular cases and making explicit generalizations.

In contrast, knowledge is represented in PDP models by the strengths of connections among the units, rather than by the storage of some static pattern somewhere in the system. Learning is simply the adjustment of the connection strengths among elements, in order to produce the right pattern of activation for the task at hand. That is, learning in these systems is not driven by a powerful computational mechanism of rule formation. Rather, it results from local adjustments in connection strengths that permit a network of elements to act in a fashion consistent with the rules, without embodying knowledge of the rules themselves.

The above description of alternative approaches in cognitive science to modeling mental processes is of necessity greatly simplified. Furthermore, the case is by no means closed with respect to the relative usefulness of sequential symbol processing and parallel distributed processing approaches to understanding cognition. At present, PDP models seem best suited for accomplishing fairly low-level cognitive activities, and their application to higher-level cognitive functions like problem solving and reasoning--which have been addressed so successfully by rule-and representation systems--remains a promissory note. The central point of the discussion has been to highlight the impact of computers on our conceptions of the nature of human cognition. In the case of sequential symbol-manipulation approaches, the computer has served as both a metaphor for and an explicit model of cognitive function. In the case of the more recent connectionist approaches, the computer has served as a standard against which to evaluate aspects of cognitive activity in terms of both architecture and efficiency. Quite importantly, it is increases in readily available computing power that have permitted parallel distributed processing models to be explored at the present level of sophistication. For the central ideas behind the connectionist approach have been presented, abandoned, and revived several times before,[5] but the implications of these insights have not been able to be realized computationally until recently.

Computers and changing modes of information presentation

One of the truly exciting possibilities and challenges that computer-related technology offers in the context of the university and society at large comes from progress in the area of computer graphics. Advances in the realistic depiction of surfaces, objects, and natural scenes in simulations of three-dimensional space are astounding. Yet more significant than the impressive realism offered by computer graphics is the potential power of two sources of information specific to computer-generated visual displays, viz., the dynamic depiction of visual information via motion in real time, and the interaction of the viewer with the displayed dynamic information.

As computer systems with powerful graphics capabilities become increasingly accessible in educational and instructional settings, it becomes important to understand and analyze the nature of a form of perceptual/cognitive skill that will be required as learners interact with sophisticated graphic displays. This cognitive ability might be called "graphic literacy," or the ability to comprehend information presented in the form of a visual/spatial display.

At some level, skill in understanding and extracting information from various types of visual representations of conceptual material has always been required to learn a wide range of traditional domains of knowledge. In mathematics instruction, for example, visual representations of information are pervasive--including the set-theoretic relations so important in early mathematical concepts, the obvious use of visual material in the learning of geometry, the graphical depiction of functions and properties of functions in calculus, and the display of surfaces and structures in topology. In all science areas, very early in the process of education, representations of the functional relationship between two or more variables--via a graph or a histogram--are essential components of understanding, as are the diagrams frequently used as aids for illustrating concepts in many aspects of physics instruction. And, the use of dynamic visual representations in illustrating more complex concepts in mathematics and science is becoming increasingly possible.

It could be argued that, in the overall process of acquiring knowledge, the ability to "read" or to comprehend visual representations of concepts and relationships is nearly as central a skill as the ability to read text. Yet despite the obvious importance of this form of literacy to learning, it is a poorly understood and largely uninstructed cognitive skill. The suggestion of the present discussion is that the comprehension of visual representations should become a more active area of both basic and applied research as advances in computer graphics become more effectively integrated into instructional situations.

At the level of basic research, there are a number of questions central to work on visual information processing that could be effectively recast as issues concerning the visual representation of conceptual information found in graphic displays. These questions include (but are certainly not limited to) the following:

(1) What are the low-level perceptual constraints on the ability to extract various forms of information from visual displays? What dimensions (e.g., color, form, brightness, size) of visual representations are most quickly and accurately encoded? Is information about change or difference relatively easy or difficult to understand? If such information is relatively easy to encode or extract, is this in reference to change in the overall quality or structure of a display of information, or change in the magnitude of represented information on one or more isolable display dimension(s)?

(2) How much and what kinds of visual information, either in isolation or interaction, produce a display of optimal complexity and comprehensibility? The experience of being overwhelmed by an "overloaded" display that attempts to communicate too much information is all too frequent. The research question concerns whether there are any underlying principles deriving from knowledge of how the perceptual system processes information that can be used to generate displays of optimal levels of comprehensibility. It should be noted that experts in the field of statistical graphics have pointed to a number of sources of

information in charts and graphs that lead to effective communication of concepts visually.[6] And, in the area of computer-generated visual displays, there has been work on human-factors aspects of display design.[7] However, findings in these fields have frequently been informal, based on the intuitions of individual experts concerning the nature of the perceptual skills of the viewer. What is needed is systematic empirical assessments of the adequacy of these principles for generating comprehensible visual displays.

(3) What are the primitive visual structures that the human perceptual system most readily and automatically encodes and represents internally? This research question has been addressed by the work of Treisman and her associates concerning the structural variables associated with early stages of perceptual and attentional processing of displays.[8] In addition, it would be productive to explore what minimal types of information (e.g., information available in a caricature vs. a realistic photograph) must be present for viewers to understand and to recognize meaningful relationships among objects depicted visually. Further variations on this same theme include asking whether organizational factors in perception can be exploited in producing easily comprehensible displays. For example, can motion of groups of elements be used as an organizing or an attention-drawing principle? Can portrayed three-dimensional structure be used as a tool in presenting information more effectively? Cooper has suggested that the use of three-dimensional models may be effective in drawing on natural perceptual strategies of viewers.[9]

At the level of applied research concerning the use of visual displays in actual instructional settings, there also exist a large number of questions ripe for systematic empirical examination. These questions include (but, again, are hardly limited to) the following:

(1) What kinds of information or domains of knowledge are most appropriately expressed in a spatial or a structural format? For example, could types of visual patterns be used to communicate abstract trends and relations in areas not generally associated with the visual display of information? An intriguing suggestion along these lines

comes from the idea of Beyerchen that self-similar patterns based on fractals could be used as models of historical or cultural change.[10]

(2) How do properties of visual displays interact with preferred representational modes or strategies of learners in producing a maximally adaptive instructional environment?

(3) How does the format for effective presentation of information in a display change with changes in the questions that the learner is asking of the display? Relevant to this question is the finding of Pinker and Kosslyn that information about single values of a variable is extracted most readily from graphs in which this value is represented by length of a line segment.[11] However, information about global trends of a variable is most easily extracted from graphs in which the values are represented by segment angles, causing the graph as a whole to have a recognizable visual pattern.

(4) What cognitive characteristics of learners interact with structural characteristics of displays in limiting or in enhancing the comprehensibility of graphic material? Furthermore, can these cognitive characteristics be modified by training, and can they be utilized in designing individual-learner suited displays of conceptual information?

The questions above represent just a sample of the types of research issues that arise from the potential for using computer-graphics technology in educational settings. And this set of questions is directed primarily toward instruction in domains of science, thus leaving aside the multitude of possibilities for instruction and creation in the arts that are afforded by the graphic capabilities of computer-generated displays. It is also to be hoped that behavioral scientists with interests in human perception, cognition, and performance will begin to explore the computer display not only as a tool for research, but also as an object of scientific study.

Concluding remarks

The information-processing revolution and the introduction of digital computers to research have far-reaching consequences for universities and, more generally, for the process of acquiring and representing knowledge. The present discussion has focused only superficially on two such consequences that are close to my own scientific concerns. The first is the continuing and changing role of the computer as both a model of and a tool for modeling the human mind. Significant advances in our understanding of the nature of human cognition--which would have been virtually unobtainable without the development of the computer--may rank among the most profound achievements of the twentieth century. The second is the role of computer graphics in expanding the horizons of modes of information presentation in a visual format. Two properties of computer displays--their inherent dynamic dimension and the ability of the viewer to interact with the display in real time--bring with them a host of possibilities for application in education as well as a number of compelling research issues for the behavioral science community.

Notes

[1] J. Haugeland, *Mind Design* (Cambridge, MA: MIT Press/Bradford Books, 1981), p.2.

[2] A. Newell and H. Simon, *Human Problem Solving* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1972); on the latter, see, for example, J.R. Anderson, *The Architecture of Cognition* (Cambridge, MA: Harvard University Press, 1983).

[3] J.L. McClelland and D.E. Rumelhart, *Parallel Distributed Processing: Explorations in the Microstructure of Cognition. Volume 2. Psychological and Biological Models.* (Cambridge, MA: MIT Press/Bradford Books, 1986). See also D.E. Rumelhart and J.L. McClelland, *Parallel Distributed Processing: Explorations in the Microstructure of Cognition. Volume 1. Foundations.* (Cambridge, MA: MIT Press/Bradford Books, 1986).

[4] D.E. Rumelhart & J.L. McClelland, *Parallel Distributed Processing: Explorations in the Microstructure of Cognition. Vol. 1: Foundations.* (Cambridge, MA: MIT Press/Bradford Books, 1986), p. 6.

[5] See, for example, D.O. Hebb, *The Organization of Behavior* (New York: Wiley, 1949); K.S. Lashley, "In Search of the Engram" in *Society of Experimental Biology Symposium No. 4: Psychological Mechanisms in Animal Behavior* (London: Cambridge University Press, 1950), pp. 478-505; and F. Rosenblatt, *Principles of Neurodynamics*, (New York: Spartan, 1962).

[6] C.F. Schmid, *Statistical Graphics*, (New York: Wiley, 1983) and E.R. Tufte, *The Visual Display of Quanititative Information*, (Chelshire, CT: Graphics Press, 1983).

[7] D.A. Shurtleff, *How to Make Displays Legible* (La Mirada, CA: Human Interface Design, 1980).

[8] See, for example, A. Treisman, "The Role of Attention in Object Perception," in O.J. Braddick and A.C. Sleigh (eds.), *Physical and Biological Processing of Images.* (New York: Springer-Verlag, 1983); and A. Treisman and J. Souther, "Search Asymmetry: A Diagnostic for Preattentive Processing of Separable Features," *Journal of Experimental Psychology: General* 114: 1985, 285-310.

[9] L.A. Cooper, "Mental Models of the Structure of Visual Objects," in B. Shepp and S. Ballesteros (eds.), *Object Perception: Structure and Process* (Hillside, NJ: Erlbaum, 1989).

[10] Alan Beyerchen, "Nonlinear Science and the Unfolding of a New Intellectual Vision," *Papers in Comparative Studies*, 6:1988-89, 25-49.

[11] S. Pinker and S.M. Kosslyn, *Graphs for People* (New York: Holt, Rinehart and Winston, in press).

A Dialogue on Computers and Education

Charles Csuri and Franklin Roberts

Interviewer: One of the most revolutionary changes in higher education during the past half-century has been the introduction and widespread use of computers. Charles Csuri and Franklin Roberts have been deeply involved with recent innovations in this area, and we have asked them to describe recent developments in their fields and the ways in which these developments might be expected to influence the university of the future. Dr. Roberts, is there an area of study specifically devoted to the use of computers in education?

Roberts: My field is educational technology. At least that's the term I give to it. Other people use terms like computer-based learning, computer-based training, computer-assisted learning, instructional technology. My definition of this field relates to the goal of educational technology--that is, to understand, to advance, and to apply all relevant technologies for the improvement of learning environments. The key phrase here is all relevant technologies. Actually educational movements are but reflections of larger social movements, and while the computer revolution is a kind of scientific revolution, it is also a social revolution. In this sense, educational technology is a social movement.

Interviewer: Can you tell us how this social revolution came about?

Roberts: One of the problems in my field is rapid change. When people in educational technology talk about needing to learn from history, they look back upon what was happening six months ago. But in order to comprehend humanistic education in individualized instruction, which is at the forefront of implementing these ideas in today's educational environments, we need to go back at least 25 years to the early 1960s, when a dramatic impetus was imparted to the field by bringing together the computer and B. F. Skinner's behaviorist ideas about teaching machines. At that time, the IBM 1500 systems were flourishing; they no longer are. In my mind, the essence of that development was encapsulated in John Carroll's model of schooling; he assumed that all people can learn all things if they have enough time and are given the appropriate instruction. Some people might take longer to learn than others, and a very few might be incapable of learning at all, but Carroll's assumption reflects what has become the key focus of this movement--individualized instruction. And that focus has remained at the center of educational technology, although this may be unfortunate in the sense that educational technology has more than individualized instruction to offer. When I became actively involved in the early 1970s as a mathematics educator, the most hotly debated issue among my colleagues was whether we should use calculators in the classroom. Since then, computer hardware and software have become infinitely more sophisticated, and psychology has evolved from behaviorism to cognitive approaches, although this has not necessarily led to more adequate explanations of learning behavior.

Interviewer: Dr. Csuri, I can imagine that progress in your field of computer imaging has occurred at an equally rapid pace.

Csuri: Yes, of course advances in the field of computer technology are occurring with tremendous rapidity. The capacity to generate sophisticated images that used to require expensive mainframe computers is already available on desktop micro-computers. Already the new McIntosh has sufficient power to produce graphic displays that until recently could only have been done on machines costing more than $250,000. Sun microcomputers now sell for less than $10,000, and they are more powerful than mainframe computers were merely 10 years ago. By the end of this year, it is estimated that we will have machines with a capacity of eight mips (million instructions per second). This is roughly eight times more powerful than the computers that generated the images I have been working on for the past ten years. By the end of 1988, this-capacity will be increased to 16 mips, and by the end of 1989 to 32 mips. By the year 2,000 we may well have supercomputer power on our desktops.

Interviewer: What relationship does this rapid advance in technology have to the economy and to the university programs in which computer graphics are taught?

Csuri: The computer graphics industry already accounts for $6 billion in annual income. Projections indicate that this figure will rise to $23 billion by 1992. This growing market is reflected by the rapid increase in professional involvement in the field. Thirteen years ago, perhaps 200 people might have attended a computer graphics conference; today that figure has increased to more than 25,000 participants at major conferences. Approximately 100 educational institutions have already introduced computer graphics in their art programs. More than 400 are offering courses in computer graphics.

Interviewer: Dr. Roberts, how have advances in computer technology affected the actual teaching of students?

Roberts: Around 1980 microcomputers began to proliferate. Now we have networks, local area networks, and distributed processing. The question is: how can resources best be deployed to achieve the educational goals of the university? In software, we have gone from programming languages to authoring languages, and we are already talking about authoring systems. Each step in this evolution has obliged us to address the more global issues involved in seeking to accomplish the goals of instructional programming. The single most important technology, however, stems from advances in our knowledge about instruction and learning. The "programmed instruction" movement has evolved into a science of instruction during the past 18 to 20 years as research in individualized instruction, aptitude testing, interactional programs, and other areas has led to rule learning, the use of feedback, advance organizers, testing strategies, adaptive instruction, adjunct questions, concept learning, an awareness of knowledge structures (based on the work of Bloom and many others), procedural learning, learning styles, and the use of motivation in instruction. All this has occurred during the past 20 years, and it is almost impossible to predict the direction this movement will take in the next 20 or 50 years.

Interviewer: On the basis of your experience, what are the principal contributions of these developments?

Roberts: There are four main areas in which cognitive science and artificial intelligence have contributed to the evolution of instructional technologies. The first is in traditional computer-assisted instruction (CAI), which usually involves a set of single lessons comprised of tutorial lessons or drill practices, which the student completes by responding to computer prompts. Second are the intelligent tutoring systems that have been developed during the past 15 to 20 years. These differ significantly from traditional framebased CAI in the sense that they provide a reactive learning environment. Instead of question-answer, feedback, branch, question-answer, feedback, branch, they are based upon a network of knowledge through which the student is allowed to flow. However, most of this work is still being done in the research labs and has, as yet, had little impact upon what actually happens in classrooms. Perhaps by the year 2000, it will have replaced the older CAI systems.

Third is the development of knowledge-based courseware. This area promises to have the greatest impact upon the university of the future. As nearly everyone realizes, we are currently experiencing an information explosion. In the field of education alone, more than 2,000 journals are published every year. Each of them puts out at least 4 issues; that amounts to more than 500,000 pages of journal articles each year in the field of education alone. No professional can keep abreast of all this information. No student--graduate or undergraduate--can have access to all this information, synthesize it, and use it effectively. However, much of this information is being put on electronic data bases. Unfortunately, most data bases are incompatible; they have weak formats, weak structures. But if we can develop instructional courseware that can work on generalized knowledge-based structures, the future will hold the promise not only of information-retrieval, but of using information-retrieval paradigms that include instructions about the knowlege contained in these data bases.

To advance in this direction we need to develop the fourth area--the systematic specification of instructional strategies. The literature is permeated with little rules that research has shown to be effective in assuring the delivery of effective instruction. We need to assimilate this literature and explicitly represent these research results in rule-based paradigms, using production systems. We know a lot, but it is not organized. Artificial intelligence and cognitive science can give us the mechanisms to organize what we know and to make it useful.

Interviewer: There has been considerable discussion lately about the potential for expert systems. What exactly are they?

Roberts: Expert systems are essentially software programs that mimic expertise. They take some problem domain and provide a system that can solve problems in that domain just as a human expert might solve such problems. One advantage of an expert system is that, once a conclusion is reached, the system can usually backtrack and explain the rationale for how a solution was obtained. Expert systems are not cheap to build, but because there are usually few human experts to perform such problem-solving tasks, software can be used to expand the pool of available experts. Furthermore, if systems can explain their reasoning, they may be able to teach people about the sort of reasoning required in a particular domain. By extrapolation, they become potentially capable of teaching about the domain itself. Expert systems can also be used for solving educational problems and learning how to engineer other systems from which knowledge can be extracted.

Interviewer: Dr. Csuri, what new developments do you see emerging in the field of computer graphics, particularly with regard to its potential for the future education of university students?

Csuri: Videotape and compact disk technology units will be integrated with personal computers for the storage of pictures and text. Fiber optics networks enable us to think in terms of satellite communications, systems linkages, and parallel processing. Resources of this nature have enormous potential for conducting experiments on how we visualize images. Computer graphics is more than pretty pictures; it is a way of exploring the parameter space, of seeing relationships graphically that might not otherwise be seen. The hope is that this will enable scientists to do better science, but computer-imaging technology also has important ramifications for the liberal arts. When art students and computer science students are mixed together, for example, they learn from each other. Thus, artists are moving into areas of thinking that involve the tools of artificial intelligence; they are beginning to talk about algorithmic aesthetics, rule-driven animation, music-driven animation, or the use of scientific models like fluid flow as a control system for the design of aesthetically pleasing objects. This interaction between art and science holds out great promise for a new integration of the liberal arts in the university of the future.

Interviewer: What are the implements of the trade for artists working in the medium of computer graphics?

Csuri: All sorts of surrogate tools are already available for the creation of computer images. We can make paint brushes and pencils; we can emulate notebooks; we can do diagrammatic sketches on screens; we can mix text and graphics, and we can design tracking algorithms that capture the decision-making process as it occurs. Certainly expert systems could be developed to determine optimal lighting conditions, the most dramatic eye points, and the best combinations of motion and color for animation.

Interviewer: What are the possibilities for the use of computer technology in the university of the future, and what are its limitations?

Csuri: The potential is virtually limitless, and our imaginations spawn countless possible applications for this technology, but there is a giant step between what happens in the research laboratory and what can be adopted by people who want to use systems that have these kinds of capabilities. In computer science, people spend little time worrying about user interface. However, there are really serious issues involved in attempting to integrate computer-imaging capacities with the needs of potential users. We don't know enough about how pictures are actually processed in the human mind; we don't know enough about visualization and about what's involved when you try to specify shapes and forms in three-dimensional space. Although we have command languages and all kinds of devices (e.g., dials, buttons, light pens, track balls, 3-D digitizers, etc.), it is not clear what the best methods are for creating productive interfaces between the user and the computer. I suspect that this problem will be addressed primarily by the commercial sector rather than by universities that seem to be more interested in basic research.

Interviewer: Do you feel that such technology will ever become a required part of the university curriculum?

Csuri: It can have a tremendous impact upon the educational process, but our success in adapting it depends upon the availability of congenial user interfaces and upon the creativity we bring to it. It is easy to become excited about the possibilities of computer-imaging techniques, but implementing them will be costly. Despite my own enthusiasm for the use of these techniques to improve learning through visualization and simulation, I realize that a great deal of work needs to be done before they can be fully integrated into core programs at the university of the future.

Interviewer: Dr. Roberts, in your opinion, what are the implications of educational technology for the education of citizens in the university of the future?

Roberts: There are two major areas in which developments in this area are likely to have a significant influence: curriculum and teaching. In regard to curriculum, we will be obliged to consider the problem of computer literacy. The very definition of literacy is changing dramatically in all fields. There are no exceptions. We need to consider what sort of literacy will be needed in the future and what sort of curriculum can foster it. Industry and government are spending massive amounts of money on education and professional development, and if the university hopes to remain relevant in this environment, it will have to devise curricula capable of providing adults with the sort of literacy they will need. What about teaching? Even professors of education generally can't teach well. They have a tendency to focus solely on their own subject matter. They perpetuate the issues which predominated in their own research. But that's not what students really need to know to be educated, effective citizens. We have to think not only about knowledge, but about the use to which knowledge will be put. Some of this knowledge should be put to use to help teachers teach more effectively, and instructional technology can be instrumental in facilitating this process.

Survey of Faculty Opinion About the University of the Future

Ella Kirk
and
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In conjunction with the "University of the Future" symposium that took place in May 1987 on the Ohio State campus, a survey of faculty opinions about the goals and objectives of the university was conducted. Ohio State provides an excellent sample population for such a poll because it is one of the largest and most diversified universities in the country. As one faculty member has only half jokingly suggested, "any problem that exists in American higher education will be apparent at Ohio State, for it clarifies problems by magnifying them." The 638 respondents to the survey represent 21 percent of the university faculty and constitute a representative cross-section by rank, area of specialization, and number of years in the profession. For example, 35.7 percent of the respondents held the rank of full professor, 25.9 percent that of associate professor, and 38.3 percent that of assistant professor, lecturer, or other; 34 percent had been at The Ohio State University from 1 to 10 years, 32.6 percent for 11 to 20 years, and 33.2 percent for more than 20 years. Responses were received from every school and college in the university, although the response rate was highest in the Schools of Agriculture and Medicine and in the College of Humanities.

One salient result of the survey was the overwhelming support it revealed among faculty members from all areas of specialization for the goals usually associated with a broad general education for undergraduate students. When asked to rate the relative importance of 16 possible objectives in the education of undergraduate students, faculty members listed the following most frequently: develop problem-solving skills, sharpen the quality of students' minds, promote familiarity with a general body of knowledge, foster creativity, enhance comprehension of basic scientific principles, and encourage familiarity with scientific methods. By a substantial margin, the development of problem-solving skills was viewed as the most important goal of undergraduate education. Fully 71.6 percent of those responding to the survey felt that this objective was "extremely important," and 96.8 percent considered it either "extremely" or "very" important. Sharpening the quality of students' minds was regarded as "extremely important" by 58.6 percent of the respondents (88.1 percent thought it was extremely or very important). On the basis of these findings, it might be useful for American colleges and universities to develop some way of measuring the effectiveness of their undergraduate requirements in developing students' problem-solving abilities and sharpening the quality of their minds. If students should learn to think critically by the time they receive a BA or BS degree, perhaps university faculty ought to look more closely at the intellectual skills and habits of mind that are cultivated in courses required for graduation; such qualities may, in the long run, prove even more important than the specific content of such courses. For the university of the future, the implication is that at least some courses should be consciously designed and taught to improve the critical thinking processes of students.

In recent debates over higher education, the two next most important objectives--promoting familiarity with a general body of knowledge and fostering creativity--have often been placed in opposition to each other. Whereas creativity and self-awareness were rallying cries for educational movements that gained momentum in the late 1960s and early 1970s, the defense of a well defined canon of required texts has become the hallmark of educational critics like Allan Bloom and former Secretary of Education William Bennett, who attach moral and social value to the acquisition of a common American culture.

What the results of the Ohio State survey seem to indicate, however, is that these two goals are not mutually exclusive. If only 41.2 percent of the respondents felt that familiarity with a general body of knowledge was "extremely important," 85.6 percent considered it extremely or very important. By comparison, 52.9 percent regarded the fostering of creativity as extremely important, whereas only 77.5 percent viewed it as extremely or very important. What is significant is that more than 75 percent of all faculty respondents placed considerable emphasis on both goals as part of the university's mission in the education of undergraduate students.

The first step in attaining these goals would appear to be a definition of what might be included in a "general body of knowledge" and of what is meant by creativity. Even a cursory examination of existing curricula at American universities will reveal that there is little consensus about any specific knowledge that should be assimilated by all students before they graduate, although significant efforts are being made on many campuses to reexamine this question. In contrast, there is some doubt about whether creativity can be taught, and the term itself means something quite different in the medical school and in the college of the arts. Yet it does seem that creativity can be encouraged and nurtured when it does occur, and the university of the future would be well advised to remain sensitive to the possibilities of creative thinking. Indeed, the Ohio State faculty seems to be saying that a university functions best when there is a stimulating tension between a commonly shared body of knowledge and a creative response to that knowledge.

A large majority of survey respondents felt that undergraduate students should be expected to acquire a familiarity with scientific methods and principles. Although only about 30 percent considered it extremely important, nearly 80 percent regarded it as extremely or very important. It is hardly surprising that the importance accorded to these qualities varies considerably according to the respondents' areas of specialization. Whereas 75 percent of the respondents in natural resources, 41.7 percent of those in medicine, and 38.2 percent of those in agriculture expressed the opinion that familiarity with scientific methods is extremely important, only 21.7 percent of those in the humanities thought it was that central to undergraduate education. With the explosion of scientific knowledge in recent decades, it has become increasingly difficult to prescribe the contents of a scientific component for the BA and BS degrees, and it may well be fruitful for university faculty to explore the possibility of devising new courses that cross disciplinary boundaries, introducing students to various scientific approaches and familiarizing them with the vocabulary of contemporary science, while showing them how to obtain the specific information they need when they need it.

Faculty concern for general educational goals can also be seen in their attitudes toward graduate and professional education. For example, only 21.8 percent of the faculty respondents thought that pre-professional training should be an extremely important part of the undergraduate program, and only 6.8 percent strongly agreed with the statement that "undergraduate education should constitute a preparation for graduate study." In contrast, faculty members were convinced that it is possible to identify a body of knowledge that every undergraduate could be expected to master and a set of intellectual skills that every student might reasonably be expected to acquire. This means that, contrary to what many people in the general public seem to think, faculty members are overwhelmingly in favor of regarding undergraduate education as a general preparation for life rather than as preparation for any specific job that graduates may hold in the future.

With regard to the undergraduate core curriculum, faculty members tended to believe that the university should cultivate an understanding of Western and non-Western culture, although there were sharp divergences of opinion on this issue according to disciplinary affiliation. For example, 24.7

percent of all respondents thought it extremely important for undergraduate students to acquire an understanding of Western culture, and 17.2 percent regarded it as extremely important for them to learn about non-Western cultures. However, in the Humanities college, the spread between these two figures was much greater; whereas 42 percent of Humanities college faculty members placed extreme importance on an understanding of Western culture, only 18.8 percent believed that a knowledge of non-Western cultures was that important. In contrast, only 10.5 percent of the respondents from the School of Agriculture and only 6.7 percent of the respondents from the Business School were of the opinion that a knowledge of Western culture was extremely important within the context of undergraduate education; only 5.3 percent of those from Agriculture, and not one single respondent from the Business School, regarded an understanding of non-Western culture as extremely important. Interestingly, attachment to the idea that the conservation of Western culture is a major obligation of the university is nearly twice as strong among faculty members who have been at the university 16 years or more than it is among those who have been there 15 years or less. Such data certainly implies a foreseeable change of focus in programs that will be articulated by faculty members in the university of the future. Whereas older faculty and conservative commentators like Bennett and Bloom tend to advocate the conservation of Western culture and the acquisition of a common American culture through a well defined canon of required texts, younger faculty appear increasingly receptive to the study of a more universal, less culturally particularized curriculum. In this context, it is interesting to note that support for teaching about non-Western cultures was strongest in the social and behavioral sciences, art, journalism, and social work.

Other commonly cited objectives of undergraduate education were regarded as considerably less important by Ohio State University faculty members. For example, American colleges and universities are frequently viewed as vehicles of upward social mobility, but half the respondents to the survey felt that this goal was of little or no importance in defining the university's mission, although faculty members in veterinary medicine and dentistry attached somewhat more importance to it. Less than 20 percent of all respondents believed that character development was an important function of undergraduate education, yet faculty members in medicine and dentistry consistently rated it higher. There was relatively little support for fostering ethnic or religious self-awareness as a primary goal of undergraduate education; perhaps surprisingly, the strongest opposition to this goal was expressed by faculty members from the Humanities college.

A much higher percentage of respondents felt that an undergraduate education should increase students' awareness of social issues like race, gender, and poverty. Slightly more than 50 percent regarded this objective as extremely or very important, and faculty members from the School of Education tended to place more emphasis upon it than did their colleagues from other parts of the university. In general, support for the university's role in heightening social awareness is strongest among younger faculty members, for 55.3 percent of respondents who had been at the university for 15 years or less considered it to be extremely important, whereas only 39.6 percent of those who had been at the university for 16 years or longer shared this opinion.

Activities that are not central to the intellectual development of students tend to be regarded as less important by faculty members. For example, 22.3 percent of the respondents strongly agreed with the statement that "major sports like football and basketball detract from the educational mission of the university." The greatest opposition to the role played by revenue-producing athletic events at Ohio State was voiced by faculty members from the School of Engineering (37.8 percent strongly agreed with the above statement and only 5.4 percent strongly disagreed with it). Much stronger support came from the agriculture, pharmacy, and dentistry faculties. Similarly, the vast majority of respondents to the survey regarded extracurricular activities in general as only moderately important. Less than 10 percent of the faculty thought the university should place substantial emphasis on creating an off-campus environment that reinforces its educational mission, but support for this objective was substantially higher (31.6 percent) among respondents from the College of Arts. A slightly larger number (11.1 percent) felt that the university should play a major role in promoting the health and physical well-being of undergraduate students, although this goal was supported with somewhat more enthusiasm by faculty members from the School of Medicine (20.3 percent). The tentative conclusion that can be drawn from these statistics is that, if the university of the future is to reflect the priorities set for it by current faculty members, it will have to focus more sharply upon the intellectual skills and knowledge that undergraduate students might be expected to acquire during the course of their studies.

Another aspect of the modern university is revealed by the fact that faculty members almost unanimously regard its research mission as crucially important. Among faculty respondents, 79.7 percent strongly agreed with the statement that the university has a significant role to play in the "generation of new knowledge," and in the most conspicuous show of consensus in the entire survey, 99.5 percent expressed overall agreement with this proposition. In general, there was strong opposition to allowing private donors and federal agencies to determine research priorities in return for their support, although faculty members from the Colleges of Agriculture and Engineering were far more willing to accept such influence in determining the university's research agenda, presumably because they tend to work more closely with such funders in the area of applied research.

Opinions are much more split with regard to the question of whether the university ought to play a major role in promoting economic development in society. If a majority (55 percent) feel that it should, only a relatively small percentage (8.6 percent) strongly agree with the statement that "the university should promote economic development," whereas 22.2 percent are generally unfavorable toward this idea. The most enthusiastic support for this role of the university was expressed by faculty members in agriculture, medicine, dentistry, and education. Thus, although faculty members overwhelmingly support the university's research mission, they are far more ambivalent with regard to the relationship between this research and practical applications of it. Those involved in applied research are inclined to accept the influence of outside funders, whereas those who are not tend to emphasize the university's obligation to perform basic research.

Within recent years, the university has frequently been called upon to take a public stand on issues of overriding moral or social concern. Faculty members themselves are split on this issue. Slightly more than 50 percent of them agree that the university is justified in adopting such positions. What is surprising is that the strongest support for this idea comes from faculty members in business, medicine, and pharmacy, whereas the strongest opposition to it was voiced by faculty members in agriculture, mathematics, and the physical sciences.

In contrast, a substantially smaller number of faculty members (41.4 percent) expressed overall agreement with the proposition that "the university should encourage social change." The greatest level of support for considering the university as an instrument of social change came from respondents in social work and in the social and behavioral sciences (although there was also strong opposition to this idea in the latter disciplines) and from younger faculty members as opposed to older ones.

Even fewer (36.3 percent) felt that the university was justified in acting as the conscience of society, although respondents from social work were far more enthusiastic about this role, whereas those from agriculture and engineering were far less supportive of it. The survey results seem to indicate, therefore, that there is considerable disagreement among faculty members with regard to a university's appropriate role in the moral life of society at large. Such differences can be explained in part by the divergent concerns of academic disciplines which interact with the public in different ways, but it undoubtedly also reflects a broad spectrum of personal beliefs and political convictions.

Among the faculty in general there was a surprisingly positive response (75.9 percent favorable) to the statement that "graduate-level instruction should include some form of general education (e.g., professional ethics, history of the profession, interdisciplinary issues, professional concerns)." The acceptance of general education at this level of instruction was stronger in some areas, like education, and weaker in others, like the biological sciences; but the overall support for this idea is undoubtedly greater than it was 10 years ago, partly because there is a growing awareness of the need to contextualize the knowledge and methods of professional activity. Public discussion about the general educational goals of the university has also influenced faculty thinking about graduate and professional education.

Participants in the survey were also given the opportunity to expand upon some of their responses by identifying, for example, the skills and the knowledge they regard as crucial to an undergraduate education. Communication skills and critical thinking abilities were mentioned most frequently as the qualities that need to be acquired by students. The overwhelming faculty emphasis on reading, writing, speaking, and thinking is paralleled by their judgment that these are precisely the areas in which undergraduate students are weakest. When asked how these weaknesses can be corrected, faculty members tended to prescribe two sorts of remedy: a reform of high school education to place increased emphasis on the acquisition of these skills, and an insistence upon the more extensive use of these skills in college classrooms. A few suggested that a more selective admissions policy and/or more rigorous grading procedures would help to alleviate this situation, but others view it as a concomitant of negative individual attitudes (disinterest in knowledge, apathy, desire to be "spoon fed," passivity, general immaturity) or pervasive social proclivities (materialism, anti-intellectualism, careerism).

With the exception of communication skills and critical thinking, faculty members expressed little consensus about what skills undergraduate students should acquire, although basic mathematical techniques, computer skills, foreign languages, scientific methods, knowledge-retrieval techniques, humanistic approaches to knowledge, the capacity to interpret important political issues, and the ability to appreciate art were all cited by less than 10 percent of the respondents. If the faculty's perception of the skills issue is accurate (and it undoubtedly is), the university would be well advised to monitor its required curriculum and to find ways of assuring that all students actually possess the requisite reading, writing, speaking and critical thinking skills before they graduate, for these are the skills they will need most in their later lives.

When the question turns upon the information that undergraduate students might reasonably be expected to assimilate during their college education, the faculty provided a far less clear-cut response. No single type of information was cited by more than 11.6 percent of the respondents, and most were mentioned by less than 10 percent. Among the areas most frequently cited were: knowledge of the English language, English and American literature, American history, a basic knowledge of the world and its evolution, scientific method, world civilization, basic mathematics, Western civilization, foreign language, philosophy, fine arts, world geography, computer programming, modern technology, how to maintain interpersonal relationships, psychology, sociology, physics, chemistry, biology, economics, political science, problem-solving techniques, and ethics. Some of these areas obviously overlap, but the variety of answers to this question clearly reflects the proliferation of subject matters at the modern university. It also demonstrates the difficulty of attempting to define core curricula strictly according to content.

In response to a question about the specific books they would recommend all students to have read by the end of an undergraduate course of study, 20 percent of the faculty members who responded felt that no such list could be established. The remaining 80 percent either offered a short list of titles or stated that a canon of "classical texts" could be elaborated according to the student's area of interest. The most commonly mentioned titles were, without exception, those of well known works in the Western tradition: the *Bible*, Shakespeare's plays, the "Constitution of the United States" and the "Bill of Rights," the "Declaration of Independence," Plato's *Republic*, Homer's *Iliad* and *Odyssey*, and Dante's *Divine Comedy*.

A second group of texts was cited a bit less frequently, but it is interesting from two points of view. First, texts that are neither literary nor political begin to emerge, and, second, no non-Western texts appear even in this group, which includes Twain's *Huckleberry Finn*, Cervantes' *Don Quixote*, Thomas Kuhn's *Structure of Scientific Revolutions*, Melville's *Moby Dick*, *The Communist Manifesto*, Alvin Toffler's *Future Shock*, Milton's *Paradise Lost*, Heller's *Catch 22*, Machiavelli's *The Prince*, and Samuelson's *Economics*. There were isolated references to non-Western works like Gandhi's *Autobiography* and the *Koran*, to women like Barbara Tuchman and Ayn Rand, and to a black writer like Martin Luther King, but in general faculty members reproduced a list that is very close to the canon of "classical" texts advocated by Bloom and Bennett. In other words, there is still a strong sentiment among faculty members to perpetuate a sense of common culture based upon readings in Western literary and philosophical masterworks.

When asked what technological innovations or conceptual breakthroughs they expected to change their own field in the next 20 years, over 80 percent of the faculty respondents expressed the opinion that computer technology would have a significant impact on teaching methods and scholarly research in their areas of specialization. Citing applications that range from word-processing, computation, knowledge-based instructional programs, and computer-generated graphics to electronic mail, networking, and the accessing of data bases, they were convinced that computers will continue to revolutionize the way in which the university of the future performs its research and teaching functions. Not every faculty member was sanguine about such developments. One believed that word processors would merely compound the students' inability to think critically and to write in a coherent manner. Another feared that the mechanization of teaching and research might lead to a decline in creative thinking and a disregard for the traditional humanistic concerns of the university.

In medical fields, some faculty members predicted dramatic breakthroughs in genetic engineering and immunology (including a vaccine against dental caries and peridontal disease). Although several thought that medicine would move toward an emphasis on physical well-being as opposed to the current preoccupation with finding cures for existing diseases, at least one respondent expected patient care to become more dehumanized as the medical professions grow increasingly technological and information-oriented. In agriculture, improvements in weather forecasting and the reconceptualization of farming as a business rather than as a lifestyle will, according to several respondents, have an enormous impact on their field. The increasing use of ceramics (especially in the area of superconductivity), video-disks, and satellite communications will affect many fields; mention was also made of advances in artificial intelligence and cognitive psychology. All in all, faculty members were convinced that human beings in the university of the future will be obliged to interact with new technologies of all kinds. How can one keep abreast of such innovations? According to several respondents, the best way to gain an overview of developments in their fields is to read a good newspaper (e.g., the *New York Times* or the *Wall Street Journal*) and a general science journal like *Scientific American* or *Discover* on a regular basis.

Survey participants voiced their opinions on a variety of topics, and although many trends are discernible, the spectrum of individual opinions on any given issue remains extremely broad. With regard to the undergraduate curriculum, for example, one respondent contended it should focus on an interdisciplinary approach to an understanding of the self, the other, society, politics, and communicative skills, whereas another respondent was convinced that the purpose of a college education was not "to let students play around for four years 'finding themselves,' but to [help them] gain analytic marketable skills." Some felt that the "smorgasbord" approach to curriculum and the reliance on survey or overview courses are detrimental to students because critical thinking and analysis can best be fostered in more narrowly focused, in-depth courses.

Others argued for specific topic areas that should be covered during every student's undergraduate career: Black studies, women's studies, modern technology, human biology, principles of agriculture, nutrition, human relations, creative thinking, ethics, etc. One respondent even suggested that every undergraduate should be required to spend at least six months in a third-world country. In contrast, others objected to the proliferation of special constituency courses like Black studies on the grounds that they have little practical applicability. One thoughtful participant in the survey urged the faculty to develop a renewed respect for "introductory-level classes as a place where students discover 'the life of the mind.' At present," this faculty member continued, "introductory classes are scorned, taught (often) in a routinized manner, and, as a result, alienate those who are in the most need of a genuine introduction to learning."

In commenting on the mission of the university, some faculty members emphasized the university's responsibility to the society at large and not merely to students, while a few pointed out that the university mirrors the strengths as well as the weaknesses of that society. Others pleaded for a reaffirmation of the university's role as a center of intellectual achievement and not simply as a purveyor of vocational training. Still others emphasized the need to retain an open atmosphere in which intellectual curiosity could be aroused and information could be freely exchanged.

Several remarked that the university's primary objective should be to create the educated citizenry of the future, and one respondent defined that goal in terms of the democratic ideal. According to this faculty member, the educated citizen would be one who has acquired "respect for the human personality, faith in living and working together for the common good, and faith in the method of intelligence in all areas of living." Another faculty respondent added that "the university of the future must turn out graduates who believe in their personal ability to solve societal problems and who are motivated to give these problems their best effort." A corollary of this idea is the desire, expressed by one respondent, that students come to see their college years "within the framework of a lifetime of continued growth and learning."

Although a sizeable number of survey participants were disturbed by the increasing emphasis on research (at the expense of teaching), the passivity of students, their unwillingness to participate in their own education, and their reluctance to grapple with unfamiliar concepts, the vast majority seemed confident that the university was evolving in ways that would enable it to cope with the rapidly changing social and technological environment in which it exists. In fact, the diversity of faculty opinion that surfaced in the Ohio State survey might well be a sign of the American university's greatest strength--its capacity to tolerate a multiplicity of viewpoints and to engage them in dialogue with each other.

Appendix: Results of Faculty Survey at The Ohio State University

1. When asked how important the following goals should be in the university's mission of educating undergraduate students; the faculty responded in the following manner (all figures are percentages of the total number of responses received):

	Extremely important	Very important	Moderately important	Of little or no importance	No opinion
a) provide pre-professional preparation	21.8	34.1	37.0	6.0	1.1
b) develop problem-solving skills	71.6	25.2	3.0		.2
c) foster creativity	52.9	34.6	10.7	1.3	.6
d) promote familiarity with a general body of knowledge	41.2	44.4	13.3	.6	.5
e) cultivate understanding of Western culture	24.7	38.8	33.2	2.8	.5
f) cultivate understanding of non-Western cultures	17.2	37.1	40.1	4.7	.9
g) further character development	19.5	33.2	34.5	9.4	3.4
h) sharpen quality of mind	58.6	29.5	7.0	.6	4.2
i) develop familiarity with scientific methods	30.6	47.7	20.3	.8	.6
j) promote comprehension of basic scientific principles	32.0	47.1	19.8	.8	.3
k) facilitate upward social mobility	1.7	5.7	38.0	50.0	4.6
l) foster self-awareness among ethnic or religious groups	5.2	17.4	37.6	36.2	3.6
m) increase awareness of social issues (e.g., race, gender, poverty)	19.1	31.6	37.2	10.8	1.3
n) cultivate an off-campus environment that reinforces its educational mission	9.9	25.2	38.8	20.2	5.9
o) support extracurricular activities	4.1	19.0	57.3	17.6	1.9
p) foster activities that promote health and physical well-being	11.1	31.5	49.0	7.3	1.1

2. **When asked to check the response that corresponded most closely to their own opinion of the following statements, the faculty responded in the following manner (all figures are percentages of the total number of responses received):**

		Strongly agree	Agree	Not sure	Disagree	Strongly disagree	No opinion
a)	There is a body of knowledge with which all students should be familiar by the time they graduate.	43.0	43.6	6.5	5.4	1.1	.3
b)	There is a specific set of intellectual skills that all students should have mastered by the time they graduate.	50.7	40.4	5.1	2.9	.6	.3
c)	Undergraduate education should constitute a preparation for graduate study.	6.8	26.8	18.1	38.5	7.9	1.9
d)	The university or one of its sub-units can take public stands on issues of overriding moral and political concern.	13.0	37.4	19.7	17.1	10.7	2.1
e)	The university should promote economic development in society.	8.6	46.4	20.7	18.7	3.5	2.1
f)	The university should act as the conscience of society.	9.3	27.0	18.6	33.5	10.4	1.1
g)	The university should play an important role in conserving the cultural heritage of the Western world.	22.1	52.4	13.8	8.9	1.3	1.6
h)	The university has a responsibility to provide an environment that fosters the generation of new knowledge.	79.7	19.8	.3	.2		
i)	The university should encourage social change.	9.3	32.1	27.1	22.6	6.6	2.2
j)	The university should allow private donors and federal agencies who provide outside funding to help determine research priorities in return for their support.	3.2	21.8	13.2	28.9	32.1	.8
k)	The university should expect to receive adequate compensation for income-generating activities that take place in its facilities.	21.9	57.8	12.6	5.6	1.3	.8
l)	The current role of major sports detracts from the educational mission of the university.	22.3	21.7	14.2	31.2	10.0	.6
m)	Graduate-level instruction should include some form of general education (e.g., professional ethics, history of the profession, inter-disciplinary issues, professional concerns).	32.0	43.9	8.6	11.4	3.2	1.0

Notes on Contributors

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